

VOLUME
NO. 6

1

MAY-JUNE 1977

FIRE TECHNOLOGY ABSTRACTS



U.S. DEPARTMENT OF COMMERCE
National Fire Prevention
and Control Administration



NOTE . . .

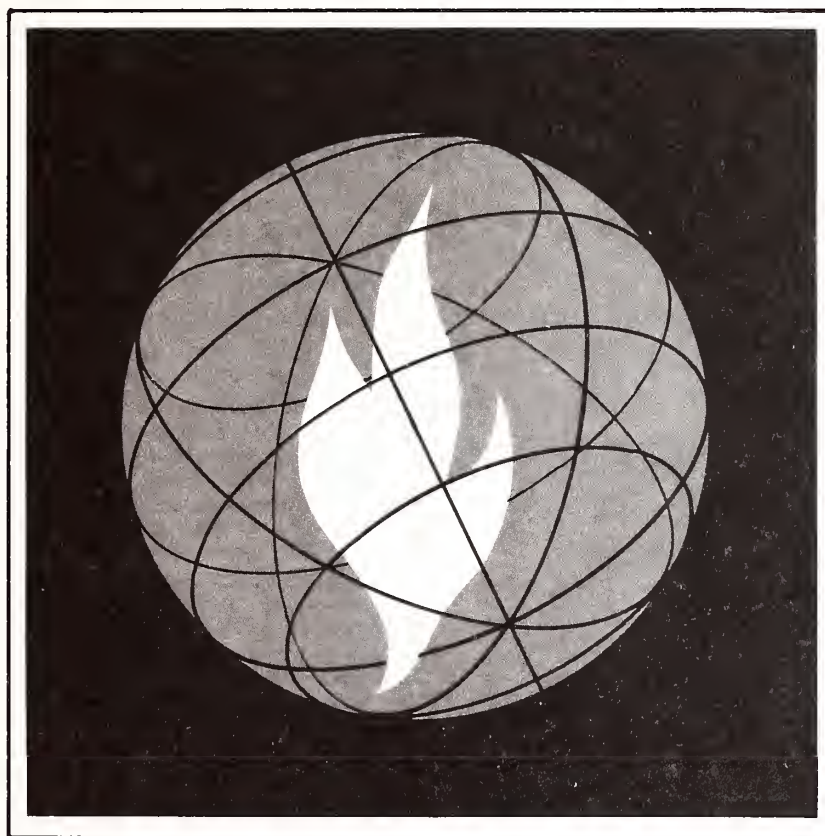
Fire Technology Abstracts is sponsored and published by the National Fire Prevention and Control Administration, U.S. Department of Commerce. Issues of this abstract journal will be published bi-monthly. Subscriptions may be ordered directly from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. The price is \$11.50 per year (\$14.50 foreign). Send check or money order payable to: Superintendent of Documents. Or charge your Supt. Docs. Deposit Account if you have one.

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U.S. DEPARTMENT OF COMMERCE
National Fire Prevention
and Control Administration
Fire Reference Service

Prepared by
Applied Physics Laboratory
The Johns Hopkins University

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FIRE TECHNOLOGY ABSTRACTS

Fire Technology Abstracts is an abstracts journal being prepared bimonthly by the Fire Problems Program Group of the Applied Physics Laboratory of the Johns Hopkins University, Laurel, Maryland, USA, under the sponsorship of the National Fire Prevention and Control Administration (NFPCA) of the US Department of Commerce. It complements the *Fire Research Abstracts and Reviews* published under the auspices of the US National Academy of Sciences/National Research Council in cooperation with the NFPCA.

SCOPE AND COVERAGE

The aim of *Fire Technology Abstracts* is to provide comprehensive reference to the applied fire literature in the broad range of topics outlined in the "Table of Contents." Most topics are covered fully; a few topics, such as forest fires and mine fires, are referenced selectively, because they are covered systematically in other specialized indexing and abstracting serials. For such topics an appropriate notice has been entered under the respective category.

The information contained in *Fire Technology Abstracts* has been gleaned from a wide variety of sources (journals, books, reports, patents, codes, and standards), with particular emphasis on the report and patent literature, for which referencing heretofore has been inadequate. Although the English-language literature comprises the majority of the entries, the coverage includes selections from the world fire literature, identified in part through such sources as *Safety in Mines Abstracts* of the Safety in Mines Research Establishment (UK), identified in the abstracts as (SMRE), the *Soviet Abstracts Journal*, Series 68, "Fire Protection," identified as (RZh), and the card abstracts issued monthly by the Fire Literature Documentation Section of the German Fire Technology Research Center at the University of Karlsruhe, identified as (Fachdok).

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ARRANGEMENT

The journal is arranged in two sections: Abstracts and Indexes.

The *Abstracts* section contains complete bibliographic description required for identification of the item, along with a brief description of the contents of the item, usually consisting of the author's abstract, summary, or conclusions. The patents entries contain, in addition, citations of the patent classes, in most cases in accordance with the international classification system, in some cases preceded by classes according to a national classification

scheme, as well as filing and disclosure dates, priorities and, if available, assignees. The abstracts are classified under the 13 main categories listed in the "Table of Contents" and a suitable number of subcategories, which are subject to revision as the necessity for finer classification arises. The page-keyed categories and subcategories of the "Table of Contents" are repeated on the appropriate pages in the abstracts section to assist the reader in rapid identification of the topical field of interest.

The *Index* section consists of four indexes: author, subject, source, and report number. Each entry in each index is keyed to an abstract number. Annual cumulative indexes will be published.

The *Author Index* is an alphabetical list of all authors cited in the abstracts section, whether principal or secondary.

The *Subject Index* entries consist of up to three hierarchic descriptive levels to characterize the nature of the subject content.

The *Source Index* displays citations in alphabetical order of the sources under the headings: Books, Codes, Conferences, Congresses, Dissertations, Journals, Meetings, Patents, Reports, Seminars, Standards, and Symposia.

The *Report Index* lists in alphanumeric order the numbers of all the reports entered in each issue, including multiple numbers, as well as the accession numbers under which reports are available from document repositories.

These indexes (as indeed the entire journal) are composed and printed out by an IBM 360/91 computer, using the INFO-360 Document Writing Package of programs developed at the Applied Physics Laboratory. The final edited file is reformatted to drive a photocomposing machine. All but the subject index are produced directly from the printed portion of the entries. The subject index terms are typed in at the ends of the abstracts, but are not printed in the body of the journal. Author affiliations, whenever available, are also included in the records. These are not printed or listed, but are reserved for future use in developing directories and the like.

AVAILABILITY

Fire Technology Abstracts is a literature announcement service only and cannot respond to requests for the documents announced in the journal. For all literature citations an effort is made to provide the information needed by the reader to acquire the document. In general, however, the full text of many of the journal articles cited in the *FTA* can be purchased through the Original Article Tear Sheet service (registered trademark OATS) of the Institute for Scientific Information (registered ISI) in Philadelphia, PA. The full text of those abstracts terminating with (Fachdok plus number) can be purchased by citing the

number and ordering from the Documentation Center of the German Fire Technology Research Center in Karlsruhe, FRG. The addresses of these two organizations are given below.

For *books, monographs, conference papers, and proceedings* the source is, in most cases, either the publisher or the sponsoring organization.

Dissertations are available in xerographic copy from University Microfilms of Ann Arbor, Michigan.

Patents can be obtained from the respective national Patent Offices.

US Reports are available for a fee from the National Technical Information Service (NTIS) or from the US Government Printing Office (GPO). If availability is not indicated, the issuing organization should be queried.

ADDRESSES

NTIS	National Technical Information Service 5285 Port Royal Road PO Box 1553 Springfield, VA 22161
Fachdok	Forschungsstelle fuer Brandschutztechnik an der Universitaet Karlsruhe (T.H.) Abteilung Fachdokumentation Hertzstrasse 16, Postfach 6380 Federal Republic of Germany
Firebase	Firebase Operations Center Boise Interagency Fire Center 3905 Vista Avenue Boise, ID 83705 Telephone: (208) 384 9457 FTS: 554 9457
GPO	Superintendent of Documents US Government Printing Office Washington, DC 20402
OATS	Institute for Scientific Information 325 Chestnut Street Philadelphia, PA 19106
Pat Off	Commissioner of Patents and Trademarks Washington, DC 20231
SFPE	Society of Fire Protection Engineers 60 Batterymarch Street Boston, MA 02110
Univ Micro	University Microfilms 300 North Zeeb Road Ann Arbor, MI 48106

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FIRE TECHNOLOGY ABSTRACTS

Volume 1, Number 6

May-June 1977

1. GENERAL

a. FIRE PROTECTION ORGANIZATION

1924. Anon

SECURITY AND FIRE PROTECTION YEARBOOK

Victor Green Publications Ltd, London, UK; 2nd edit, 261 pages, 1976

This is the second edition of the *Security and Fire Protection Yearbook*, which will be published annually. Listed in 6 sections are all the British governmental departments, public authorities, professional institutes, associations and companies involved in security and fire protection, as follows: Non-Commercial Bodies (Government departments, national authorities institutions, associations, research and teaching establishments and trade organizations); Insurance Companies; UK Police Authorities; Security Companies (and Buyers' Guide to Equipment and Services); UK Fire Authorities; and Fire Protection Companies (and Buyers' Guide to Equipment, Materials and Services).

1925. Brands F

ORGANIZATION AND EQUIPMENT OF INDUSTRIAL FIRE BRIGADES

Rev Tech Feu; 17(158):26-27, 1976 (French)

It is pointed out that every industrial enterprise in France is required to have its own fire unit equipped to handle the specific hazards of the plant. The difference between public and private fire units is that the former extinguish fires in residential and public buildings, on board ships in port, etc, while the latter, more specialized units handle those in plants. Their personnel are made up in both cases of professional firefighters, permanently employed for this purpose, but the industrial firefighters are often volunteers, even though the ratio of professionals to volunteers depends on the premise, the number of fires, and other factors. The responsibility for fire protection in plants lies in the hands of the fire safety manager. At the present time the industrial units are almost fully equipped to handle fires in their plants. The trends toward automation and mechanization have resulted in a steadily decreasing number of volunteers, with a necessity of expanding the use of sprinkler systems, flooding systems, foam generators, etc, supervised by television monitors. (RZh)

b. MEETINGS AND PROFESSIONAL ACTIVITIES

1926. Anon

COMBUSTIBILITY ISSUES IN COMMERCIAL CONSTRUCTION, RESIDENTIAL CONSTRUCTION, TRANSPORTATION, FURNITURE-FURNISHINGS

Combustibility Symp. Annual, 5th, Papers; 1976, Apr 21-22, Atlanta, GA

Sponsor: The Society of the Plastics Industry, Inc

This volume contains the 13 papers presented at the 5th Annual Combustibility Symposium sponsored by the Society of the Plastics Industry (SPI), as follows: (1) SPI Attitude Survey; (2) Flammability - What are the Best Interests of the Furniture Customer; (3) The Impact of Building and Fire Codes on Plastics Used in Residential Construction; (4) Furniture - The Molder's View; (5) Total Product Responsibility is the Ultimate in the Market Place; (6) Problems of the Vehicle Manufacturer in Meeting Today's Requirements for Fire-Resistant Rapid Rail Transit Vehicles; (7) Proposed Standards for Aircraft Interior Materials; (8) The Plastics Problem; (9) Toward Fire-Safe Systems for Mass Transportation; (10) The Use of Plastics in the Mobile Home Industry: Past, Present, and Future; (11) Are Plastics a Problem? It Depends on How You Measure It; (12) Plastics in Commercial Construction; and (13) Emphasis on the Proper Priorities.

c. LITERATURE AND NOTICES

1927. Tuve RL

PRINCIPLES OF FIRE PROTECTION CHEMISTRY

Nat Fire Prot Assoc, Boston, MA; 265 pages, 1976

This is the first textbook on fire protection chemistry to help students and fire science specialists apply the knowledge of chemistry to fire prevention, fire protection, and firefighting. The book can serve as either a practical, comprehensive classroom text or as a personal reference. Suggested readings, reviews and a comprehensive subject index are included in the text. The book is intended for a broad audience, including chemical engineers, students, educators, industrial safety personnel, and fire protection engineers. A 54-page *Instructor's Manual*, a helpful companion guide to the text with condensed summaries of each chapter, including media resources and evaluation techniques, is also available. The author is the founder and director of the US Navy's Fire Research Laboratory and is a consultant for fire research problems at the Johns Hopkins University's Applied Physics Laboratory. 69 figs, 29 tables.

1. GENERAL

d. FIRE AND EXPLOSION INCIDENT CRITIQUES AND ANALYSES

1928. Anon

LESSONS FROM FIRES IN THE TEXTILE INDUSTRIES
Fire Protection Assoc, London; 11 pages, 1976

Fire losses in the textile group of industries in the UK are running at a cost of more than 10 million pounds a year in direct damage to property (illustrated by a table of textile industry fire statistics covering the years 1970 through 1974). To this must be added many millions of pounds annually from the disruption of work that inevitably follows any serious fire. The case histories presented in this booklet (cotton/synthetic fiber processing; woollens and worsteds; production of synthetic fibers; hosiery; carpets; textile finishing; and jute, candlewick and others) have been selected from reports received by the Fire Protection Association from the fire brigades through the Home Office and the Scottish Home and Health Department. The examples confirm that the special fire hazards in these industries arise largely from the highly combustible nature of the materials being handled, textiles being the material first ignited in almost half the fires attended by public fire brigades in 1969-1972.

1929. Bruemmer D

BEHAVIOR OF CABLES IN CABLE CHUTE AND DUCT FIRES. EXAMPLE OF AN INCIDENT: FIRE IN THE GERMAN ELECTRON SYNCHROTRON (DESY)
Brandschutz; 30(12):317-318, 1976 (German)

On May 6, 1975, a fire broke out in the main cable duct of test hall I of the DESY research facility (elementary particle research). As demonstrated by the report of the fire department attack team, effective firefighting was hindered by the numerous structural deficiencies in the fire-protection system. The entire cable system of the test hall was destroyed, and large areas of the building and sub-assemblies of the facility were damaged, especially because of the HCl in the fire smoke. Based on the experience gained in this fire, a number of structural and organizational fire-protection measures are being planned for the restoration of the facility. 2 figs, 1 ref. (Fachdok 13/0302)

1930. Huebner R

CAUSES OF FIRES IN ELECTRICAL EQUIPMENT
Electro Rev; 68(33):800-802, 804-805, 1976 (German)

The damages reported in Switzerland in 1975 from a total of 1,520 fire incidents amount to about 90 million francs, an increase of 30% compared to 1974. Aside from the direct damages resulting from lightning strikes, which can be largely prevented by taking suitable precautions, about 6% of the fire causes can be attributed to deficiencies and defects in electrical equipment. These causes can be broken down into short circuits and ground leaks from defective wiring (50%), careless handling of electrical appliances (30%), and defective equipment (20%). The causes leading to such fires are discussed in detail, and tips on how to prevent and fight them are given. 9 figs, 4 refs. (Author)

1931. NFPA Fire Anal Dept
BIMONTHLY FIRE RECORD
Fire J; 70(4):33-36, 1976

Sixteen accounts of typical important fires reported to the National Fire Protection Association are presented. The fires occurred in 1975-1976 in various properties, including educational, manufacturing, institutional, storage, and residential. In some cases accounts are based on preliminary reports, which are subject to verification. Given in most cases are a brief description of the property, circumstances surrounding outbreak of the fire, fire-fighting tactics, investigative measures, damages and losses.

1932. NFPA Fire Anal Dept
BIMONTHLY FIRE RECORD
Fire J; 70(5):45-48, 1976

Fourteen accounts of typical important fires reported to the National Fire Protection Association are presented. The fires occurred in 1975-1976 in various properties, including utilities, residential, storage, manufacturing, and wildlands. In some cases the accounts are based on preliminary reports, which are subject to verification. Given in most cases is a brief description of the property, circumstances surrounding the outbreak of the fire, fire-fighting tactics, investigative procedures, damages, and losses.

1933. NFPA Fire Record Dept
BIMONTHLY FIRE RECORD
Fire J; 70(6):41-44, 1976

Twelve case histories of typical important fires reported to the National Fire Protection Association are presented. All the fires took place in 1976 in various types of occupancies, ranging from basic industry, store and office properties, to educational and manufacturing facilities. In some cases the accounts are based on preliminary reports, which are subject to verification. Given in most cases is a brief description of the premise, circumstances surrounding outbreak of the fire, fire-fighting tactics, investigative measures, damages, and losses. 3 photos.

1934. Sawyer RG and Elsner JA
CABLE FIRE AT BROWNS FERRY NUCLEAR POWER PLANT
Fire J; 70(4):5-10, 1976

Although there was no release of radioactivity during a major electrical cable system fire at the Browns Ferry Nuclear Plant of the TVA, the fire was not extinguished for seven hours and caused the shutdown of two nuclear generating plants for over a year. Damage was estimated at \$10 million, and replacement of power cost \$10 million a month. The fire resulted from a candle used to check for leaks through a fire wall penetration seal. Since the fire, the penetration design has been altered using silicone RTV as a sealant and inorganic fiberboard for fire barriers. Automatically actuated, fixed, water spray deluge systems were installed in areas of high cable concentration. 3 figs, 2 photos, 3 refs. (NFPA)

1. GENERAL

d. Fire and Explosion Incident Critiques and Analyses—Continued

1935. Rieber M
TEXTILE FIRES — THEIR ORIGIN, EFFECTS AND POSSIBILITIES OF REDUCING THEM
Lenzinger Ber; (40):69-79, 1976 (German; English Summary)

Fire accident statistics show that textile fires occur only on rare occasions. In relatively few cases are textiles themselves the primary cause of a fire, but they may contribute to a limited extent to the spread of the flame. The progress of the fire, ie, ignition, fire spread and extinguishment, brings about not only the generation of heat, but also the formation of flammable and nonflammable gases, some of which are toxic. Normal apparel offers limited protection against flame. If clothing catches fire, the fire can always be extinguished before major damage occurs, provided correct procedures are followed. In this case the behavior of the person is the decisive factor. The aim of this paper is to provide material for a correct evaluation of the significance of textile fires. Since textiles are used in almost all areas of human activity, data and evaluations can be presented on only a selected number of examples. (This paper was presented at the 14th International Chemical Fiber Conference held in Dornbirn, Austria, on 24-26 Sep, 1975.) 15 figs, 17 refs. (Author)

1936. Anon
ACCIDENTS IN PLANTS PRODUCING ALCOHOLIC BEVERAGES

Nihon Jozo Kyokai Zasshi; 71(6):414-417, 1976 (Japanese)

The causes, circumstances and consequences of several accidents, including fires, which occurred in plants producing alcoholic beverages in Japan in 1974 are described in detail. Also reported are the changes in occupational labor legislation in the Japanese food industry which have been introduced by the unions. The changes are aimed primarily at more rigid requirements for the safety of the existing production processes. Also modified in part is the distribution of responsibilities for the fire safety status between administrative and production-line personnel, as well as the procedure for investigating the causes of fires and other accidents. (RZh)

1937. Caldo C
CAUSES AND CONSEQUENCES OF FIRES IN ITALY FROM 1968 TO 1972

Textilia; 52(4):71-77, 1976 (Italian)

It has been found that the number of fires is increasing from year to year. The years 1970-1975 formed an exception, when, because of the prolonged draught, the number of forest fires increased dramatically. The number of fires in residential buildings averaged 12% of the total number of fires. Data are presented on fire victims by age groups. Of particular note is the large number of elderly among the victims. A diagram demonstrates the dynamics of the increase in losses by year, but it does not include the indirect losses which, compared with the direct losses, may reach a significant figure. Also presented is information on groups of combustible materials that served as the fire source. Fire causes as a whole and in residential buildings in particular are classified. In 60% of the cases it was not possible to establish the cause of the fire. In 10% of the cases the cause of the fire was short circuiting and faulty electrical wiring and equipment. 5 figs, 6 tables, 4 refs. (RZh)

1938. Berman GA
COLOR TV FIRES: A PERSISTENT PROBLEM

Reliability and Maintainability Symp. Annual. Proc; 1977, Jan 18-20, Philadelphia, PA, pages 27-30, 1977
 Sponsor: AIAA, AIIE, ASME, and others

In June 1970, the National Commission on Product Safety (NCPS) published its final report. It identified a variety of consumer items deemed hazardous and presented statistics citing the frequency and type of accidents sustained by their use. Among the so-called hazardous items were color television receivers. Problems of fire incidence were discussed and a figure was presented indicating that 10,000 fires resulted annually from faulty sets in the year 1969. Since publication of that document, much activity has ensued on the part of manufacturers and consumer groups. Numerous hearings have been held in which opposing views were presented. Manufacturers challenged the validity of the statistics. Consumers countered with a barrage of personal experiences. This paper addresses some of the outcomes of these hearings, reviews the case history of an incipient TV fire, and assesses the future situation of television safety. 3 figs, 15 refs. (Author)

e. FIRE SCIENCE EDUCATION

1939. Barc WK
FUNDAMENTALS OF FIRE PREVENTION

John Wiley and Sons, New York, NY; 213 pages, 1977

This book, which is part of the Wiley Series in Fire Science, is designed to provide both the student and the experienced firefighter with an understanding of the role and function of fire prevention. It can be used as a reference book for daily problem solving, for training programs, as a home study text, and as a basic textbook for introductory college courses in fire prevention. Emphasis is placed on the practical rather than theoretical aspects of fire prevention. The opening section, called The Basis, has chapters on: History; Fire: Causes and Effects; A Fire Prevention Bureau and Its Resources; and Laws, Regulations, and Standards. Part 2 deals with the environment, with chapters on Building; Automatic Fire Sprinkler Systems; Other Fire Protection and Alarm Systems; and the Contents and its Hazards. The last section discusses tools, dealing specifically with Inspection; Enforcement; Fire Investigation; Records and Data Utilization; Public Education; and Legislative Action. Each chapter has a summary, a list of review questions, and a bibliography of references.

1940. Rasbash DJ
THE EDUCATION OF FIRE ENGINEERS

Fire Eng J; 36(104):35-38, 1976

What is meant by the subject of fire engineering, that is, the content of the subject in terms of safety, fire engineering, and total approach, as well as the nature of those who stand in need of education in the subject, that is, those who have a substantial or dominating professional interest in the subject of fire safety, are discussed in this paper presented at the Institution of Fire Engineers Conference at Harrogate (UK) on 11-12 October, 1976. Developments in informal education, in which the Institution of Fire Engineers and the Fire Protection Assoc are

1. GENERAL

c. Fire Science Education—Continued

active; formal education, as given at the Department of Fire Safety Engineering at the University of Edinburgh; the field of use of the MSc degree in fire engineering; and bridging the gap between academic knowledge and the main areas in which the subject is practiced in the UK by specialist classes on particular themes, round out the discussion of fire engineers education in the UK.

1941. Sheen PAD

THE CHALLENGE TO FIRE ENGINEERS

Fire Eng J; 36(104):32-34, 1976

The subject of the fire engineer, his education, training, and status is developed in this paper presented at the Institution of Fire Engineers Conference at Harrogate (UK) on 11-12 October, 1976. It is pointed out that to strive after status is useless, but if the education and training are right, then status will follow. The idea of having this Institution join the ranks of chartered institutions is rejected. The ideal system being recommended is a correspondence course run by the Institution and aimed at a graduateship examination. The modalities of this scheme, in particular the "learning objectives" syllabus and preparation for examination, are described in full on the basis of syllabus and preparation examples.

f. LEGISLATION

1942. Smith RB

SMOKE DETECTORS IN ALL DWELLINGS REQUIRED BY RETROACTIVE LAW

Fire Eng; 130(3):53-54, 1977

The background of the successful signing of the public safety law requiring the installation of smoke detectors in all dwellings in Montgomery County, Maryland, by July 1, 1978, is recounted.

1943. Selle K

THE LEGAL POSITION AND RESPONSIBILITY OF SAFETY SPECIALISTS

VFDB Z; 26(1):22-25, 1977 (German)

According to the Labor Safety Law (FRG) the employer bears the main responsibility for labor safety and fire protection. He can draw on safety specialists to support him. The way in which the individual titles of the Labor Safety Law regulate the discretionary powers and responsibilities, the right of the plant council to voice its opinion, and the formation of the labor protection committee are outlined. In the case of deliberate or negligent infringement of the legal regulations, the safety specialist is liable according to criminal, public order or civil law. The specific consequences of these legal regulations in the case of personal or property loss are discussed. (Fachdok 13/0413)

1944. Anon

FEDERAL FIRE PREVENTION AND CONTROL ACT OF 1974. LEGISLATIVE HISTORY. VOL 1. Nat Fire Prev and Control Admin, Washington, DC; PB-263 461/6GA, 612 pages, 1975

Availability: NTIS

Various bills introduced in the House and Senate, excerpts from the Congressional Record, reprints of hearings pertaining to Public Law 93-498 (the Federal Fire Preven-

tion and Control Act of 1974), and several Senate and House reports are included in the legislative history. The two volumes are continuously paginated. Vol 1 contains an index. (See also Vol 2, PB-263 462.)

1945. Anon

FEDERAL FIRE PREVENTION AND CONTROL ACT OF 1974. LEGISLATIVE HISTORY. VOL 2. Nat Fire Prev and Control Admin, Washington, DC; PB-263 462/4GA, 657 pages, 1975

Availability: NTIS

Vol 2 of a two-vol series continues the legislative history of a federal fire control and prevention act. (See also Vol 1, PB-263 461.)

g. RESEARCH AND DEVELOPMENT PROGRAMS

1946. Anon

INFORMATION DIRECTORY 1977

Building Research Establishment, UK; 50 pages, 1977

In 1972 the Building Research Station merged with the Fire Research Station and the Princes Risborough Laboratory (formerly the Forest Products Research Laboratory) to form the Building Research Establishment. This directory contains details of all the Building Research Establishment's main publications that are currently available, and information on films, seminars and the Building Research Establishment. Some publications listed in the directory are from series now superseded. "BRE Report" is the overall title now applied to major works. The aim of this directory is to help professional users to find the publications about BRE research of use to them. Titles that are out of print are not listed. Papers that are published only in journals are also omitted but are listed in BRE Annual Reports. Often reprints of these papers can be obtained from the authors. Many technical libraries keep complete sets of papers but in case of difficulty write to the publications officer at BRE Garston. Details of where and how to get the publications, packages and films are given on page 4.

1947. Bellet H

THE MANIFESTATIONS OF FIRE

Ann Inst Tech Batim Trav Publics; 29(341):50-52, 1976 (French)

This article is devoted to general problems associated with the outbreak and development of a fire (primarily in urban surroundings), its energy characteristics, and the way it progresses as a function of temperature and time in various cases. The combustion of various materials, the phenomenon of synergism, the generation of smoke, similarity and modeling in studies of these phenomena are discussed. Research is presently being conducted at the Fire Laboratory on the initial phase of fires, synergism, and three-dimensional fire problems.

1948. Blair JA

FIRE RESEARCH: A PROGRESS REPORT FROM THE PLASTICS INDUSTRY

Fire J; 70(6):57-63, 1976

The technical programs of the Society of the Plastics Industry have been altered to deal more directly with actual fire hazards that can be adequately defined. Scale

1. GENERAL

g. Research and Development Programs—Continued

tests are to be developed that will lead to controls for proven fire hazards in given product applications. The approach to the combustibility research of the plastics industry involves hazard data to determine which may be "unreasonable" hazards, and research to develop effective measurement and control methods for the major defined hazards. 6 refs. (NFPA)

1949. Anon

FIRE ON THE TEST STAND

Oesterr Feuerwehr; 30(5):98-99, 100, 1976 (German)

A new fire research laboratory has been established in Mennedorf, Austria, at a cost of 2.5 million florins. The laboratory is housed in a large building with a floor space of 350 m² and a height of 12 m. The building is divided into several areas designed for various studies. One of the areas (10 m³) is equipped for fire tests in which the parameters of the combustion processes of various materials are determined. The research area is equipped with modern instruments to measure smoke density, temperatures at various points, the CO₂ content in the air, etc. A climatological device exists for testing fire detectors and other apparatus for equipping ocean-going vessels. Fire detectors are tested in a wind tunnel at a wind speed of up to 20 m/sec. In other sections tests are made to determine the effectiveness of various extinguishants (water, CO₂ gas, hydrogen halides). Experimental data are obtained primarily by automatic electronic instruments with indication on large lighted signal panels and are recorded on special tapes. The results are processed mathematically by computer.

1950. Anon

COURSE OF ACTION — EFFECTIVENESS AND QUALITY (FIRE ENGINEERING STATIONS)

Pozhar delo; (9):20-22, 1976 (Russian)

An All-Union Conference of the heads of the Fire Engineering Stations was held in Donetsk (USSR), and the course of action taken during the 9th five-year plan to specialize research in the various stations was evaluated. Papers were presented on the following topics: the advances made in the preceding five-year plans; the principal directions of research in the fire-protection field; the research carried out at the Astrakhan, Kuibyshev and Sverdlovsk Stations and ideas on further improvements in research; research methods and how to present the results; and ways of improving the effectiveness and quality of the research done at the Fire Engineering Stations and of increasing their effect on fire-fighting organization. The advances made in recent years are attributed to collaboration with inter-institutional organizations and enterprises.

2. DYNAMICS AND MECHANICS OF FIRE**a. FIRE BUILDUP, PROPAGATION, AND SPREAD**

1951. Vogel BM

A STUDY OF FIRE SPREAD IN MULTIFAMILY RESIDENCES

Build Stand; 46(2):56-59, 80, 1977

This article is a reprint of NBSIR 76-1194, revised to reflect Uniform Building Code references. For a review of the article, see *FTA* 1(5), abstract 1536.

1952. Tourrette J-C and Toyer M

RATE OF FIRE DEVELOPMENT AS A FUNCTION OF TYPE OF COVERING

Cah Cent Sci Tech Batim; (170):117-118, 1976 (French)

The capability of combustible coverings to promote the development and spread of fire, ie, their combustibility, is determined by fixed standards, which have been highly simplified, since it is impossible to take into account the complexity of the phenomena and many parameters. Therefore, the total ignition times for an entire enclosure are determined by fire tests of building sections, either full-scale or 1/3 of full-scale. It has been found that floorings do not appreciably affect the development of a fire, but when floors are covered with combustible materials, eg, parquetry, pulsating generation of volumes of smoke was observed as a result of incomplete combustion owing to inadequate supply of oxygen. During fires in an enclosure with a parquet floor, the maximum air temperature at the ceiling reached 800°C in 30 min. When the walls were covered with a polystyrene foam, the maximum ceiling temperature of the air reached 700°C in 30 minutes, but complete ignition of the enclosure was not observed. The influence of a wall covering of synthetic fibers on a paper base was tested only on a fragment of reduced dimensions. During the tests the material peeled off from the wall, fell, curled up and burned before the entire enclosure caught fire, which occurred five minutes later. 3 figs.

1953. Sekine T

EXPERIMENTS TO STUDY THE SPREAD OF FIRES IN CITIES

Kasai; 26(1):46-65, 1976 (Japanese)

A description and the results of complex experimental investigations to determine the conditions of fire spread during fires in large urban tracts by modeling are presented. The models of urban structures for the investigations were made of natural materials in simplified form. The following parameters were varied: the location of the seat of the fire and of several fire sites relative to each other; the strength and intensity of the simulated wind; and the humidity and temperature of the ambient medium. The outlines of the spreading flame front were recorded in equal time intervals and topographical fire fields were made on this basis. Conclusions are drawn relative to the most stable trends of fire spread, as well as to the most vulnerable sections in urban tracts. 45 figs, 7 tables. (RZh)

1954. Anon

FIRES IN VARIOUS TYPES OF BUILDINGS

Kasai; 26(1):19-23, 1976 (Japanese)

The nature and progress of fires in buildings differing in purpose, shape, construction, dimensions and location are described. The characteristic features of the fire-spread process typical of each type of building are derived. Data on 14 fire incidents in the last four years in Japan were used for this purpose. It is pointed out that such an analysis, based on data from 600-800 fires,

2. DYNAMICS AND MECHANICS OF FIRE

a. Fire Buildup, Propagation, and Spread—Continued

using modern statistical methods and computer technology, should make it possible to establish objective trends in the nature of fire spread and development for each of the most widely found building types. It is reported that an analogous statistical study was made in the USA in 1974 on the basis of data from 2,400 fires of varying scale, making it possible to work out specific recommendations with regard to fire prevention and extinguishment applicable to the majority of the types of buildings investigated. 7 figs, 1 table. (RZh)

1955. Emmons HW

COMPUTER FIRE CODE (II). Harvard Univ, Div Eng Appl Phys, Cambridge, MA; TR-20, 36 pages, 2 figs, Jan 1977

An approach to the development of a method of computing the history of a fire in an enclosure is proposed. Since many people will be studying the components of a fire for many years, the enclosed computer flow chart has been designed to permit anyone who works on an individual component to produce a computer code for that part independent of the remainder. Eventually it should be possible to compute the progress of a fire with any desired degree of precision (although present precision is very low). When arbitrarily high precision is possible, any practical need can be satisfied by suitably reducing the precision and correspondingly simplifying the program. (Author)

1956. Fernandez-Pello AC

FIRE SPREAD OVER VERTICAL FUEL SURFACES UNDER THE INFLUENCE OF EXTERNALLY APPLIED THERMAL RADIATION. Harvard Univ, Dept Eng and Appl Phys, Cambridge, MA; TR-19, 84 pages, 20 figs, 32 refs, Jan 1977

Upward flame spread velocity over vertical sheets of polymethyl methacrylate (PMMA) and downward flame spread velocity over vertical sheets of PMMA, filter paper and white pine wood were measured under the influence of externally applied radiant fluxes ranging from 0 to 2.0 W/cm². The flame spread rate was found to be dependent on the surface temperature of the fuel prior to flame arrival. For both modes of fire spread a power law correlation exists between the flame spread velocity and the difference between the vaporization temperature of the fuel and its surface temperature prior to flame arrival. An approximated theoretical model for upward laminar flame spread was developed and present theoretical models for downward flame spread were extended to account for the additional effect of external radiation. It is shown that the predictions of the theoretical models agree qualitatively with the experimental observations. (Author)

1957. Williams FA

MECHANISMS OF FIRE SPREAD

Combustion Symp, Internat, 16th, Proc; 1976, Aug 15-20, MIT, Cambridge, MA, pages 1281-1294, 1977

Sponsor: The Combustion Institute, Pittsburgh, PA

Mechanisms involved in many types of fire spread are described in a manner that sacrifices accuracy for the purpose of emphasizing general aspects of the underlying heat-transfer, fluid-flow and chemical-kinetic phenomena.

Consideration is given to conditions for transition from one mode of propagation to another. Research on fire spread has been pursued intensively in recent years, and in the present contribution an attempt is made to provide a framework within which various studies can be placed. Entries to current literature are provided. Areas of apparent importance that do not seem to have been emphasized are suggested. 96 refs. (Author)

b. FLAMMABILITY, IGNITION, AND EXTINCTION

1958. Tamanini F

A STUDY OF THE EXTINGUISHMENT OF VERTICAL WOOD SLABS IN SELF-SUSTAINED BURNING BY WATER-SPRAY APPLICATION

Combust Sci Technol; 14(1,2,3):1-15, 1976

Experiments were carried out on the extinguishment of burning slabs of three different thicknesses. The results are presented in terms of experimental correlations of the mass lost during control and time required for control of the fire as functions of the rate of water application. A simple power law with exponent in the range (-1.5)-(-1.75) was found for the dependence of the first two variables on the latter. The predictions of a theoretical scheme, based on a pyrolysis model for the solid, a simple estimate of the flame energy feedback, and an extinguishment criterion for the flame were found in agreement with the experiment. The calculations confirmed the existence, already indicated by the experiment, of a minimum rate of water application below which no mass is saved. Furthermore, the theory indicated an upper limit, above which the efficiency of the water spray decreases. 7 figs, 1 table, 21 refs. (Author)

1959. Tamanini F

THE APPLICATION OF WATER SPRAYS TO THE EXTINGUISHMENT OF CRIB FIRES

Combust Sci Technol; 14(1,2,3):17-23, 1976

A set of correlation parameters, derived from an earlier study of the extinguishment of slab fires by water sprays, is used to present results obtained with cribs. The parameters are generally satisfactory, except for the case of cribs with large stick size (03/4 in. and up) and low preburns. It is proposed that an additional parameter be introduced that accounts for the fact that at low preburns, only a fraction of the structure is in self-sustained burning. Power law correlations are presented for the mass lost and the time required for extinguishment as functions of the rate of water application. The existence of a critical value for the rate of water application below which the fire cannot be controlled before total consumption of the fuel is also confirmed. 5 figs, 9 refs. (Author)

1960. Shigenobu S and Mitsue F

IGNITION OF MP CONDENSERS

Kasai; 26(2):97-101, 1976 (Japanese)

A number of cases of fire breaking out as a result of ignition in electrical capacitors made for resonance circuits of low-current radio circuits is reported. It is shown that the capacitors most susceptible to fire are those made of metallized paper (so-called metallized paper type capacitors) with an operating temperature of no more than 125°C. Analyzed in detail is the mechanism of ignition

2. DYNAMICS AND MECHANICS OF FIRE

b. Flammability, Ignition, and Extinction—Continued

which, as a rule, occurs in domestic electrical appliances. A description is given of the arrangement and operating principle of the test stand on which laboratory tests of this phenomenon were conducted. Also presented are the results of investigations that formed the basis for specific recommendations on changes in the production process, as well as improvement in the process of soldering leads of capacitors made of metallized paper in order to ensure the fire safety of the circuits. 17 figs, 2 tables. (RZh)

c. FLOW OF COMBUSTION PRODUCTS

1961. Sato K

SMOKE MOVEMENT IN A BUILDING. PART I — CALCULATION BY AN APPROXIMATE METHOD AND EXPERIMENT ON SMOKE-AIR STRATIFIED FLOWS IN THE UNSTEADY STATE

Rep Fire Sci Inst Japan; (42):28-37, 1976 (English)

In order to find out whether there is any foundation for the fear that the smoke-movement calculation method is not actually reliable and, if possible, to dispel this fear, a number of investigations and tests were made, as described in detail in this article. All the results showed that the approximate calculation is completely reliable and is in good agreement with the results of other studies and trials. There is no reason to abandon this proven method. 12 figs, 2 tables, 8 refs. (Fachdok 13/0469)

1962. Karlsruhe Fire Prot Eng Res Center

STUDY OF THE REQUIREMENTS AND DESIGN OF VENTILATION SYSTEMS IN HIGHRISE BUILDINGS TO FULFILL THE FIRE-PROTECTION REQUIREMENTS FOR ESCAPE ROUTES IN CASE OF FIRE. Univ Karlsruhe, FRG, Fire Prot Eng Res Center; Forschber T 149, 52 pages, 14 figs, 3 tables, 8 refs, 1976 (German)
Availability: Fachdok

In order to determine the quantities of combustion products issuing from an apartment during a fire and flowing into a compartment ahead of it, a calculation method was developed that determined the flow conditions between the fire compartment and an adjacent compartment from the temperature conditions in these compartments. On the basis of experimental results in a 22-story apartment building and other investigations known from the literature it was possible to give limit values for the tolerable smoke density in escape routes. In addition, design temperatures for the air intake and exhaust ventilators and the associated ducts were established; also found were the temperatures that can occur in building components in case of fire when the ventilation system is in operation and when it fails. (Fachdok 13/0363) (Author)

1963. Weinberg FJ and Wang W W-Y

OPTICAL STUDIES IN FIRE RESEARCH

Combustion Symp, Internat, 16th, Proc; 1976, Aug 15-20, MIT, Cambridge, MA, pages 799-807, 1977
Sponsor: The Combustion Institute, MIT, Pittsburgh, PA

In order to characterise the flicker frequency about which optical fire detection devices should operate, a study of flow and turbulence in fire plumes is carried out using optical methods. New laser-based techniques for measuring flow and temperature fields over large test areas are developed. They include a form of subtractive

infinitesimal shear interferometry that allows temperature gradients to be measured with unprecedented accuracy over two-dimensional objects of almost unlimited working-space area. The turbulent fire plumes under study are produced by burning liquid fuel in pans of various diameters, both under unconfined conditions and in the presence of a "ceiling". Among the conclusions are relationships between dish diameter and flame height, plume width, horizontal and vertical velocities and intensities of turbulence, as well as the flicker frequencies that would be experienced by a transilluminating light beam. The velocities are approximately inversely proportional to the square of the height in the strongly buoyant lower regions, and follow an inverse 1/3 power law in the weakly buoyant upper regions, as predicted by theory. 6 figs, 12 refs. (Author)

**1964. Hwang CC, Chaiken RF, Singer JM and Chi DNH
REVERSE STRATIFIED FLOW IN DUCT FIRES: A TWO-DIMENSIONAL APPROACH**

Combustion Symp, Internat, 16th, Proc; 1976, Aug 15-20, MIT, Cambridge, MA, pages 1385-1395, 1977
Sponsor: The Combustion Institute, Pittsburgh, PA

In ventilated duct fires, smoke and other combustion products may form a layer near the ceiling and flow in the direction opposite to the ventilation flow. Previous workers have shown that backing of hot combustion products occurs if the ratio of the buoyancy head $H\Delta T/T$ to the velocity head V^2/g is greater than unity. A two-dimensional mathematical model of the phenomenon is developed based upon the interaction of a steady-state fire plume with a cross ventilation flow. The objective of the analysis is to gain some understanding of the behavior of the hot gas layer flow and its response to changes at the fire source and in the ventilation current. Through the present mathematical treatments it appears possible to predict the effects of ventilation speed, duct inclination, mass flux of fire plume, etc, on the critical length of the reverse flow layer. The detailed flow behavior of plumes and gas layers can also be studied with the model. 8 figs, 2 tables, 15 refs. (Author)

d. INSTRUMENTATION

1965. San Miguel A and Rieger JL

CONSTRUCTION AND USE OF A SMOKE-MEASURING TRANSDUCER

Fire Technol; 12(4):303-310, 1976

A smoke measuring transducer was designed for use in a Navy A-4 aircraft cockpit subjected to a simulated carrier deck fire (JP-5 fuel). The measured levels of smoke density were correlated with the other aspects of fire-induced structural degradation measured simultaneously. A calibration of light attenuation in a standard smoke chamber permitted the burn test measurements to be correlated empirically with factors such as human vision and the type of material producing the smoke. The use of the smoke measuring transducer in the burn test gave data not previously available. 7 figs, 13 refs. (NFPA)

2. DYNAMICS AND MECHANICS OF FIRE

e. METEOROLOGY

f. RADIATION

1966. LeBotlan Y and Bellet H

STUDY OF ENERGY FLUXES OF CLASS B-1 FIRES TO DETERMINE THE SUITABILITY OF EXTINGUISHERS*Face au risque*; (125):49-51, 1976 (French)

In a previous article a study was made of the heat radiation that can be withstood by humans. In the present paper, a study is made of the anomalies that are detected when hand fire extinguishers are used on class-B fires. Here the prime interest is the distance from the heat source. Distances required for heat fluxes of varying intensity are given in diagrams and the intensities from fires of the classes 8-B-1 to 59-B-1 are given in tables. It is then pointed out that different hand fire extinguishers must be used for the different kinds of fires. 2 figs, 3 tables. (Fachdok 13/0429)

1967. Alpert RL

PRESSURE MODELING OF FIRES CONTROLLED BY RADIATION*Combustion Symp, Internat, 16th, Proc*; 1976, Aug 15-20, MIT, Cambridge, MA, pages 1489-1500, 1977

Sponsor: The Combustion Institute, Pittsburgh, PA

Pressure modeling involves the reduction of all length scales as the minus 2/3 power of ambient air pressure in order to preserve gas phase dynamics and solid phase thermal response during a fire. This concept has been critically tested until now only for convection dominated fires. The burning rate and radiant output of large-scale PMMA wall and pool fires dominated by radiative heat transfer are compared with model results in the present study. At ambient pressures from 5 to 35 atmospheres, measurements with PMMA walls from 10 to 41 cm high clearly show that modeling of fuel mass flux variations and overall burning rate of full-scale PMMA walls up to 360 cm high is highly successful. It is found that while radiative fluxes from the fire to the environment are often not modeled for such large wall fires, the net radiative feedback from flames to the fuel surface is approximately modeled. The computed magnitude of surface reradiation and the computed variation of flame radiation with pressure explain the detailed behavior of the model burning rate relative to that at full-scale. The degree of success observed here in modeling burning rates of PMMA pool fires up to 122 cm across at 1 atm is shown to be entirely consistent with the wall fire results. While the detailed behavior of the model pool and wall fires may not precisely simulate full-scale effects, the accuracy of overall predictions based on model results is still impressive. 5 figs, 1 table, 11 refs. (Author)

1968. Orloff L, Modak AT and Alpert RL

BURNING OF LARGE-SCALE VERTICAL SURFACES*Combustion Symp, Internat, 16th, Proc*; 1976, Aug 15-20, MIT, Cambridge, MA, pages 1345-1354, 1977

Sponsor: The Combustion Institute, Pittsburgh, PA

Measured burning rates per unit area in a large-scale vertical polymethyl methacrylate (PMMA) wall fire experiment are found to increase nearly linearly with height

along the 3.56-m high slab. The radiative heat feedback from the flames to the fuel surface is derived from radiance measurements using a gray flame analysis. Radiative heat transfer accounts for 75 to 87% of the total heat feedback to the burning surface. Results for thin and gray flame models are compared, with fuel scale and flame absorption coefficient as parameters. The asymptotic burning rate, where the flame emissivity is unity, may be as high as 123 g/m²s, on the basis of an effective flame radiation temperature of 1367°K for PMMA. Computed PMMA flame transmittance versus radiance characteristics in the radiance range 0 to 1.5 W/cm²sr are shown to be similar to that of turbulent ethane and propane flames. 5 figs, 1 table, 7 refs. (Author)

g. THERMAL CONDUCTIVITY

3. BEHAVIOR AND PROPERTIES OF MATERIALS

[For literature on fire and flame retardants, fire and flame proofing, etc see Chemical Abstracts.]

a. CHARACTERISTICS AND THERMAL BEHAVIOR OF MATERIALS

1969. Taylor W and Scott KAC

FIRE PERFORMANCE AND TESTING OF PLASTICS

The Plastics and Rubber Inst, London; 35 pages, 1976

This monograph is intended for those especially interested in the present-day problems of fire and in the relation of those problems to plastics. It is not written for specialists in the different areas of technology, but is primarily meant to provide a reasonable picture of present approaches and to stimulate thinking on the subject of fire. The monograph contains eight chapters devoted to the historical background of plastics in fire, today's fire problems, the influence of plastics in fire losses, review of some major fires, approach to legislative controls of materials, fire tests — present situation, toxic gases in fire, and the fight against fire — a critical study. A bibliography of 11 references is included.

1970. Anon

COMPARATIVE ANALYSIS OF THE POSSIBLE CONTRIBUTION OF THE MAIN SYNTHETIC INSULATING MATERIALS TO THE INCREASE OF HAZARDS IN CASE OF FIRE BY VARIOUS LABORATORY TESTS*Cah Cent Sci Tech Batim*; (170):115-116, 1976 (French)

On the basis of various laboratory tests it has been found that rigid urethane foam at about 200°C gives off large quantities of yellow smoke that reduces visibility considerably and can cause suffocation. Hydrocyanic acid forms at high temperatures. At a temperature of about 230°C rigid polyvinylchloride gives off a white smoke that not only reduces visibility, but is also hazardous because it contains a concentrated solution of hydrochloric acid. When these materials burn, they begin to release combustible gases at 400 and 450°C; these temperatures are reached slowly if the insulating materials are retarded. Porous polystyrene does not cause smoke logging at temperatures up to 200°C, but at 330°C it emits combustible

3. BEHAVIOR AND PROPERTIES OF MATERIALS

a. Characteristics and Thermal Behavior of Materials—Continued

vapors and gases. It burns highly exothermically and gives off large volumes of black soot. If this material is turned over to the unheated side, it disintegrates as a result of thermal deformation, the rate of which depends on the fire endurance limit of the protective coating. When this coating decomposes rapidly, the porous polystyrene melts and burns intensely, but combustion stops quickly because of the small amount of polystyrene in the structure. Phenolic-foam materials are not highly combustible, melt slowly in the solid phase, and do not release harmful smoke, except carbon monoxide in small amounts. Phenolic-foam materials are fire retardant, at least in the fire development phase, and do not cause an increase in fire hazard. When rigid polyvinylchloride or polyurethane are used as insulation, the smoke and gas generated within the structure should be removed. 2 figs.

1971. Damant GH and Young MA
SMOLDERING CHARACTERISTICS OF FABRICS USED AS UPHOLSTERED FURNITURE COVERINGS

J Consumer Prod Flammability; 4(1):60-113, 1977

This study is an attempt to evaluate in some detail the upholstery fabric/filling material interface under conditions of cigarette ignition. The inherent smoldering qualities of about 90 representative fabrics, in combination with an inert substrate, are documented. The change in fabric smoldering qualities as primary substrates are changed and the interaction of typical fabrics with common primary filling materials are discussed. In addition, the effect of fabric variables, such as fiber content, weight, backcoating, test direction, and construction on smoldering characteristics of fabrics/substrate systems is examined. Twenty-nine general conclusions are drawn. 2 figs, 30 tables, 30 refs. (Author)

1972. Christian WJ, Castino GT and Beyreis JR
FIRE BEHAVIOR OF BUILDING INTERIOR FINISH MATERIALS

J Fire Flammability; 8(1):41-58, 1977

Full-scale and laboratory experiments have been performed using 29 materials, including plastic, mineral, and wood products. In the full-scale experiments, the materials were applied as surface finish in corner and room geometries and exposed to ignition sources of various intensities. Observations were made of fire propagation, temperature, and radiant heat flux. Laboratory-scale fire tests conducted on the same materials included the Steiner Tunnel (UL 723, ASTM E-84, NFPA 255, ANS A2.5), radiant panel (ASTM E-162), the NBS Heat Release Rate Calorimeter, and the Ohio State Heat Release Rate Apparatus. Results of the full-scale experiments and relationships with the laboratory fire tests are presented. 6 figs, 2 tables, 22 refs. (Author)

1973. Starrett PS
FACTORS INFLUENCING FLAME SPREAD RATES IN SOLID MATERIALS

J Fire Flammability; 8(1):5-25, 1977

The developing technology of mathematical fire modeling requires accurate input data from laboratory flame-spread tests. Current test methods produce confusion and often contradictory results. The observed flame-spread behavior of cellulosic specimens could be predicted on

the basis of a simple heat-transfer model. Geometrical factors, such as orientation and specimen surface area per unit weight, were shown to have a dominant influence on flame spread. The effect of altitude on flame spread in small and full-scale specimens was explored. A reliable laboratory test for determining the flame spread of fire-retardant materials under simulated fire conditions has yet to be developed. 13 figs, 1 table, 14 refs. (Author)

1974. Tewarson A
HEAT RELEASE RATES FROM BURNING PLASTICS

J Fire Flammability; 8(1):115-130, 1977

A laboratory-scale flammability apparatus has been used to measure convective heat-release rate and generation rates of smoke and combustion products for CH_4 , C_2H_6 , CH_3 , OH, polyoxymethylene, polymethylmethacrylate, and polystyrene burning in air. This paper is a progress report of a continuing study on flammability of plastics supported by the Products Research Committee (c/o Dr. J.W. Lyons, National Bureau of Standards, Washington, DC). 6 figs, 4 tables, 3 refs. (Author)

1975. Kourtidis DA, Parker JA and Hilado CJ
THERMOCHEMICAL CHARACTERIZATION OF SOME THERMOPLASTIC MATERIALS

J Fire Flammability; 8(1):59-94, 1977

The thermochemical and flammability characteristics of some typical thermoplastic materials currently in use and others being considered for use in aircraft interiors are described. The properties studied included: 1) thermomechanical properties such as glass transition and melt temperature; 2) changes in polymer enthalpy; 3) thermogravimetric analysis in anaerobic and oxidative environments; 4) oxygen index; 5) smoke evolution; 6) relative toxicity of the volatile products of pyrolysis; and 7) selected physical properties. The generic polymers that were evaluated included: acrylonitrile butadiene styrene, bisphenol A polycarbonate, 9,9 bis (4-hydroxyphenyl) fluorine polycarbonate-poly (dimethylsiloxane) block polymer, phenolphthalein-bisphenol A polycarbonate, phenolphthalein polycarbonate, polyether sulfone, polyphenylene oxide, polyphenylene sulfide, polyaryl sulfone, chlorinated polyvinyl chloride homopolymer, polyvinyl fluoride, and polyvinylidene fluoride. Processing parameters, including molding characteristics of some of the advanced polymers, are described. Test results and relative rankings of some of the flammability, smoke, and toxicity properties are presented. Under these test conditions, some of the advanced polymers evaluated were significantly less flammable and toxic or equivalent to polymers in current use. 12 figs, 14 tables, 47 refs. (Author)

1976. Carl W
THE FIRE BEHAVIOR OF TEXTILES

Lenzinger Ber; (40):88-95, 1976 (German; English Summary)

The problems involved in the fire behavior of textiles are presented on the basis of the present status of the regulations and laws that are presently in preparation in industrial countries. The classification of fibers currently on the market for major uses, eg, domestic textiles and clothing, is described in terms of standardized scientific

3. BEHAVIOR AND PROPERTIES OF MATERIALS

a. Characteristics and Thermal Behavior of Materials—Continued

test procedures. Also discussed are the most important physical, chemical and technological variables that affect the burning behavior of textiles, such as the structure of the fabric, finishing, and the fiber material. (This paper was presented at the 14th International Chemical Fiber Conference held at Dornbirn, Austria, on 24-26 Sep 1975.) 13 figs, 4 tables, 7 refs. (Author)

1977. Eulenburg PR

THE FIRE BEHAVIOR OF TEXTILES FROM THE FIRE SERVICE VIEWPOINT

Lenzinger Ber; (40):240-247, 1976 (German; English Summary)

Textiles as an essential component of the human environment also constitute a hazard for this environment. As organic materials they are flammable. Due to their close contact with the skin in the form of clothing, flammable textiles can lead to severe injuries. As domestic textiles they promote fire spread and the generation of large-scale fires. The most important causes for the development of a hazard to human beings are careless handling of open fire; effects of solid combustible materials in the form of wooden or metal particles (sparks) during combustion, welding, thermocutting etc; the effects of readily flammable gaseous or liquid materials, such as oxygen; and the effect of radiant heat. Reducing the flammability of textiles, ie, making them flame-resistant, seems to be the way of reducing the hazard they represent. In addition, however, preventive measures such as those contained in building codes or trade-union codes of practice should prevent man's immediate environment from becoming a hazard to him. (This paper was presented at the 14th International Chemical Fiber Conference held at Dornbirn, Austria, on 24-26 Sep 1975.) 19 refs. (Author)

1978. Green RJS, Richard CJ and Smith DA

THE BEHAVIOUR OF POLYMER PRODUCTS IN REAL FIRES

Plast Rubber; 1(1):42-43, 1976

The thinking that led to the construction of a new fire-test facility for investigating the fire performance of polymeric products is described. The studies indicate that the most meaningful way of examining the real-fire behavior of polymers is to analyze measurements made on components exposed to a range of practical fire conditions. The parameters to be considered include the rates and extents of combustion, spread of flame, formation of smoke and toxic gases (CO, CO₂, HCl, HCN, SO₂, etc). It is hoped that improved correlation with laboratory studies will eventually lead back to the development of simple small-scale assessment procedures that can be used with confidence. 2 figs, 4 refs. (Author)

1979. Prager DI

FIRE BEHAVIOR OF PLASTICS — A NEW HAZARD IN THE BUILDING SECTOR? PART 1

Plastica; 29(11):382-390, 1976 (German; English Summary)

A survey is given of the burning characteristics of some plastics used in building construction in this two-part article. The requirements for plastics, the testing and classification of building materials and components according to the building-inspection requirements in the FRG, and the testing and classification of building materials in the

Netherlands and France are reviewed in this first part of the article. 28 figs.

1980. Prager DI

FIRE BEHAVIOR OF PLASTICS — A NEW RISK IN THE BUILDING SECTOR? PART 2

Plastica; 29(12):428-431, 1976 (German; English Summary)

Building-component testing principles and special building-component tests, and the fire manifestations such as smoke density, relative toxicity of smoldering and combustion products, and the relative toxicity of pyrolysis products are discussed in this second part of the review article. It is concluded that plastics are no new risk in the building sector if tests and applications that take this risk into account precede their use. 8 figs.

1981. Anon

STRATEGY FOR THE INVESTIGATION OF PLASTICS AND FIRE. British Plastics Federation, London; BPF 157/1, 1976

The objectives, scope and outline for an investigation of plastics in fire are described in this report by the British Plastics Federations's Fire Committee. The investigation is to consist of a survey to be carried out on existing research work in other industries, such as the hazards of exposure to smoke and toxic combustion products in aircraft.

1982. Hagglund B and Persson L-E

THE HEAT RADIATION FROM PETROLEUM FIRES.

Forsvarets Forskningsanstalt, Stockholm, Sweden; FOA C 20126-D6(A3), 33 pages, 11 figs, 2 tables, 14 refs, Jul 1976

The heat radiation from JP-4 fuel fires was studied. The pool sizes were between 0.5 and 10 m². Both the spectral and the total flame radiant intensities were measured as functions of the pool size. The total intensity increased with increasing flame depth and approached the value of 13 W·cm⁻² at the flame depth of 150 cm. With further increase of the fire size the values of the intensity were considerably smaller due to smoke-blocking effects of the flame zone. A method of measuring the distribution of the radiant energy over the fire plume by means of an IR-camera is described. Finally a simplified method is presented, based on the measured data, to calculate the radiation field near liquid fuel fires. (Author)

1983. Lee CK, Chaiken RF and Singer JM

CHARRING PYROLYSIS OF WOOD IN FIRES BY LASER SIMULATION

Combustion Symp, Internat, 16th, Proc; 1976, Aug 15-20, MIT, Cambridge, MA, pages 1459-1470, 1977

Sponsor: The Combustion Institute, Pittsburgh, PA

Utilizing a 250 watt CO₂-laser radiation source, wood pyrolysis at fire-level surface heat flux was investigated through the measurement of decomposition rates, solid temperatures and thermal properties, pyrolysis gas compositions and pressures, and crack formation. Heats of reaction calculated from these measurements show that at an incident heat flux of 0.76 cal/cm²-sec applied parallel to the wood grain direction, the pyrolysis layer (01 cm thick) can be divided into three zones: 1) an endothermic primary decomposition zone at temperatures T < 250°C;

3. BEHAVIOR AND PROPERTIES OF MATERIALS

a. Characteristics and Thermal Behavior of Materials—Continued

2) an exothermic partial char zone at $250^{\circ}\text{C} < T < 340^{\circ}\text{C}$; and 3) an endothermic surface char zone at $340^{\circ}\text{C} < T < 520^{\circ}\text{C}$. The overall mass weighted effective heat of reaction is endothermic to the extent of -146 cal/g . At $2.0\text{ cal/cm}^2\text{-sec}$ applied parallel or perpendicular to grain direction, pyrolysis reaction proceeds as a charring wave of $\sim 0.5\text{ cm}$ thickness advancing into the wood. The charring wave ($250^{\circ}\text{C} < T < 450^{\circ}\text{C}$) is characterized by active overall exothermic reactions accompanied by rapid solid density change. In front of the wave is an endothermic primary decomposition zone, and behind the wave is an exothermic char layer ($T < 800^{\circ}\text{C}$) of relatively constant density. The overall heat of reaction at the higher heat flux is exothermic, being greater for perpendicular heating ($260\text{--}410\text{ cal/g}$) than for parallel heating ($25\text{--}94\text{ cal/g}$). For parallel heating at both heat fluxes, macroscopic cracks ($\sim 1\text{ mm}$ wide) occur in the pyrolysis region, whereas for perpendicular heating no cracks are observed. Present results show that the wood pyrolysis process is dependent upon the external heating rate, the total time of heating, and the anisotropic properties of wood and char relative to the internal flow of heat and gas. 8 figs, 3 tables, 24 refs. (Author)

1984. Moussa NA, Toong TY and Garris CA
MECHANISM OF SMOLDERING OF CELLULOSIC MATERIALS

Combustion Symp, Internat, 16th, Proc; 1976, Aug 15-20, MIT, Cambridge, MA, pages 1447-1457, 1977

Sponsor: The Combustion Institute, Pittsburgh, PA

A coordinated theoretical and experimental investigation of the mechanism of smoldering in cellulosic materials has been conducted. Both steady and transient smoldering have been observed for single cylindrical cellulosic elements, mounted horizontally in quiescent oxygen/nitrogen environments of varying pressures and compositions. An extinguishment limit, separating the steady from transient regions, is observed at well-defined combinations of oxygen mole fraction and partial pressure. In the region of steady smoldering, the measured propagation speed and maximum temperature in the smoldering zone depend on the oxygen partial pressure and mole fraction in the environment. However, independent of the environmental conditions, the speed is uniquely related to the maximum temperature. It is postulated that cellulose, upon heating, decomposes to yield char and volatiles. The char then reacts with oxygen, diffusing from the surroundings, to provide the heat flux needed to sustain pyrolysis. On the basis of this mechanism, the predicted characteristics of steady smoldering and of the extinguishment limit are found to be in good agreement with the experimental results, thus demonstrating the validity of the proposed mechanism. (Author)

1985. Pagni PJ and Shih TM
EXCESS PYROLYZATE

Combustion Symp, Internat, 16th, Proc; 1976, Aug 15-20, MIT, Cambridge, MA, pages 1329-1343, 1977

Sponsor: The Combustion Institute, Pittsburgh, PA

The use of synthetic polymers in home furnishings can result in rapid fire spread throughout a structure. This appears to be caused by the generation at the fire origin of excess pyrolyzate, ie, combustible gases that are not consumed in the flame that produced them. The amount

of excess pyrolyzate is predicted quantitatively as a function of the material mass transfer number, B , and mass consumption number, r , and the ambient fluid mechanics for both free-standing and flush-mounted fuel slabs. Detailed temperature, velocity and mass fraction fields are obtained numerically from Shvab-Zeldovich analyses. Excess pyrolyzate is then found as a fraction of the total pyrolyzate by the simple species balance between the fuel surface and the flame. Flame heights for both forced and free flow are also predicted using integral analyses to describe combustion downstream of the fuel slab. Results obtained for ten common polymers are in agreement with observations that some synthetic polymers produce significantly more excess pyrolyzate than natural polymers. Applications to compartment fire tests and tunnel tests are discussed. 5 figs, 1 table, 22 refs. (Author)

b. COMBUSTION, EXPLOSION, AND FLAMMABILITY TESTS AND METHODS

1986. Hertzog G

ACTIVATION ENERGY OF MATERIALS

Face au risque; (125):25-48, 1976 (French)

As yet incomplete comparisons of activation energies among the following synthetic materials are considered in this article: various kinds of rigid polyurethane; friable foams containing phenol; various compositions of expanded polystyrenes; composite expanded polystyrenes; fiberboards; glass bricks; cork compounds; coco fiber; compact jute; fire-resistant fiberboards; glass-fiber-reinforced cellulose panels containing phenol; reed panels; elastomeric foam; fiberboards impregnated with gypsum; and, finally, "sandwich" foams, which are embedded between two or more fiberboards and cement-impregnated panels. 36 tables. (Fachdok 13/0404)

1987. Barry TJ and Newman B

SOME PROBLEMS OF SYNTHETIC POLYMERS AT ELEVATED TEMPERATURES

Fire Technol; 12(3):186-192, 1976

Development and standardization of reliable test methods are essential in the determination of synthetic polymer flammability. The test methods should be developed on an individual product and use basis, with the results presented so that they can be integrated for a safety analysis of mixed use potential. In spite of much research on the physiology of thermal stress, methods are not standardized and results are often difficult to reproduce. Little work has been done on the response to oxygen-deficient atmospheres at elevated temperatures. The prospect for complete toxicity analysis by computer appears to be excellent. 7 tables, 16 refs. (NFPA)

1988. Block I and Davidson EJ

EVALUATING THE BURNING BEHAVIOR OF FLAMMABLE APPAREL FABRICS

J Consumer Prod Flammability; 4(1):29-39, 1977

Current fabric flammability test method development has tended toward relatively simple devices that measure the temperature rise of a supervised surface adjacent to or surrounded by a burning fabric. Assuming that the data from such tests represent the actual heat transfer from a burning garment to its wearer, it is necessary

3. BEHAVIOR AND PROPERTIES OF MATERIALS

b. Combustion, Explosion, and Flammability Tests and Methods—Continued

to develop some index capable of rating the burning behavior of the fabric under test. This paper discusses the results of an investigation into the ranking of a series of fabrics rated by selected indices described herein. It is shown that, in agreement with other investigators, classification of flammable fabrics by grouping has little significant effect upon their rankings, and that a measurement of the rate of heat transfer is a satisfactory method of rating the hazard potential of flammable apparel fabrics. 3 figs, 6 tables, 15 refs. (Author)

1989. Li CC and Moore JB

ESTIMATING FLASH POINTS OF ORGANIC COMPOUNDS

J Fire Flammability; 8(1):38-40, 1977

The flammability of organic compounds is determined by measuring their flash points; that is, the temperature at which the vapor above the liquid ignites. This property is of considerable importance from the standpoint of safety. Despite its importance, no general method has been developed to estimate it. However, flash-point correlations for a particular group of compounds were developed. Presented in this note is an empirical estimation method that correlates the relative flash point as a linear function of the relative normal boiling point. 1 fig, 1 table, 3 refs. (Author)

1990. Jach W

FIRE-ENGINEERING CLASSIFICATION OF COMBUSTIBLE MATERIALS, ESPECIALLY WITH REGARD TO TEXTILES

Lenzinger Ber; (40):227-239, 1976 (German; English Summary)

Various methods for the investigation of combustion time, flame-propagation speed and burning behavior, some of them contained in German Industrial Standards (DIN), are discussed. (This paper was presented at the 14th International Chemical Fiber Conference held at Dornbirn, Austria, on 24-26 Sep 1975.) 30 figs, 12 refs. (Author)

1991. Sega S

EXPERIMENTAL STUDIES ON SMOULDERING OF SOLID MATERIALS

Nihon Kasai Gakkai Ronbunshu; 25(1/2):17-23, 1975 (Japanese; English summary)

The thermophysical Laboratory of Sapporo University (Japan) is conducting a long-term experimental and theoretical study of the smoldering processes of solid materials that are widely used in industry and represent a great fire hazard. Partial results of the experimental research conducted in 1975 on cardboard are presented. Smoldering of cardboard was studied under various conditions; in particular, factors and parameters such as the temperature of the ambient medium, the pressure, ventilation conditions and air convection, the amount and location of the smoldering centers, the configuration of the cardboard specimens (thin layers, thick piles, cardboard sheet rolled into a tube, etc), the orientation of the test specimens of cardboard in space, the humidity, the moisture in the cardboard, and the type of cardboard were varied during the experiments. Graphic displays illustrating the dependence of the rate of spread of the smoldering front and other quantitative and qualitative charac-

teristics of the smoldering process on the parameters mentioned above are given. It is stated that specific practical recommendations for increasing the fire safety of the technological processes under the conditions associated with the production, storage and use of cardboard will result from the research. 16 figs, 7 refs. (RZh)

1992. Sega S

THEORETICAL CONSIDERATION OF SMOULDERING OF SOLID MATERIALS

Nihon Kasai Gakkai Ronbunshu; 25(1/2):25-37, 1975 (Japanese; English Summary)

Mathematical formulations and the results of an analytical calculation made by specialists of the Thermophysical Laboratory of Sapporo University (Japan) for the purpose of establishing a relationship between parameters of the smoldering process of solid materials are presented. The data of the investigation are given within the framework of complex long-term (experimental and theoretical) fire research. The calculation applies to the smoldering of cardboard. It was found that the air-convection parameters influence the rate of propagation of the smoldering front over the surface of the cardboard to a greater degree than does the level of thermal radiation, in particular the air temperature near the smoldering front. The role of the latter factor is estimated, from the results of the calculation, to amount to only a few percent. It is noted that the analytical results are confirmed by the results of experimental studies of the smoldering process of cardboard. 12 figs, 1 ref. (RZh)

1993. Efremova T and Vaskin S

ROTARY DUST FEEDER (TO TEST THE EXPLOSIVITY OF DUSTS)

Pozhar delo; (11):25-26, 1976 (Russian)

A rotary dust feeder (atomizer) was constructed at the VEMIIT Fire Research Institute (USSR) to test the explosivity of various dusts. Very finely dispersed dusts were generated using a very fine sieve. With these dusts it was possible to reduce the lower explosion limit of some dusts in the explosion chamber (constructed at the All-Union Fire Protection Research Institute) from 100-120 g/m³ to 45-55 g/m³. The atomizer is particularly useful for generating and testing various textile dusts. 1 fig, 1 table. (Fachdok 13/0650)

1994. Saito N and Yanai E

WEIGHT LOSS RATES OF POLYMERS PYROLYZED ISOTHERMALLY AT HIGH TEMPERATURES IN AN AIR FLOW. PART I — CELLULOSE, RAYON AND POLYESTER FIBER

Rep Fire Res Inst Japan; (42):19-26, 1976 (Japanese; English Summary and Captions)

The weight loss rate studies were carried out at temperatures ranging from 35° to 500°C and then above 700°C. At temperatures above 700°C, however, the pattern is reversed. A reduction of the oxygen concentration from 21 to 15% had no effect whatever on the weight loss rates of cellulose and polyester fibers. 10 figs, 1 table, 9 refs. (Fachdok 13/0446)

1995. Wakabayashi K

FIRE AND EXPLOSION PREVENTION ENGINEERING

Soda to enso; 27(3):85-97, 1976 (Japanese)

3. BEHAVIOR AND PROPERTIES OF MATERIALS

b. Combustion, Explosion, and Flammability Tests and Methods—Continued

The results of laboratory studies of combustion and explosion mechanisms under various conditions are given for the following gaseous, fire-hazardous materials: acetylene, methane, propane, ammonia, and others. The design and operating principles of the laboratory test setups used during the investigations, in particular, of a test stand that permits visual observation of the distribution of burning zones in the flame, are described. The diffusion flame of a number of gases is analyzed with this arrangement. It is shown that the flame consists of three main zones. The first, inner zone consists of the fuel gas, but because of the lack of oxygen, combustion does not occur in this zone. In the second (central) zone the gas burns partially; in the third (outer) zone, the fuel mixture burns completely, the flame temperature of the acetylene reaching 2170°C, of carbon disulfide, 2280°C, and of benzene, 1410°C. Also determined during the investigations was the quantity of air needed for complete combustion of the gas. As a result, some reference data were determined more precisely; in particular, for complete combustion of 1 kg of acetylene, 13.39 m³ of air were needed, and 14.76 m³ of air for complete combustion of methane. The pressure dependence of the conditions of ignition of the gases and their mixtures with air was studied. It is shown that as the pressure of a mixture of methane with air increases from 0.1 to 12.5 MN/m² (from 1 to 125 kgf/cm²), the lower ignition limit remains essentially unchanged (from 5.6 to 5.7 vol%), while the upper limit increases from 14.3 to 45.7 vol%. At 100 kN/m² (760 mm Hg) carbon monoxide has an ignition range of 15.5 – 68 vol%; at 26 kN/m² (200 mm Hg) ignition does not occur at all. It is also noted that with increasing temperature of the fuel mixture of gas with air the ignition range expands; the lower limit decreases and the upper limit increases. Exact values for the explosion time (0.7-0.98 sec) were determined for all the gases examined. One of the test arrangements made it possible to measure, with great accuracy, the pressure during burning of the gases in a tube, as well as the rate of flame propagation. The maximum pressure for methane was about 12 MN/m² (120 kgf/cm²); the flame propagation rate was about 2,300 m/sec. Also determined was the amount of energy released during detonative combustion of the test gases. Corresponding analytic calculations were made for all the experiments. 15 figs, 6 tables, 6 refs. (RZh)

1996. Wakabayashi K
FIRE AND EXPLOSION PREVENTION ENGINEERING
Soda to enso; 27(4):121-138, 1976 (Japanese)

The results of long-term, ongoing fire research being carried out by the Fire Engineering and Fire Methods Research Institute in Tokyo are presented. At the present stage of the research project, the parameters of an explosion and of the propagation of an explosion wave from the ignition of methane and other natural gases in the mains and distributor pipelines, as well as in various production-line areas, have been determined under laboratory conditions. The following parameters were measured: the strength and directional pattern of the blast wave; the level of the acoustic detonation; the temperature fields in the area of the explosion center; the propagation velocity of the flame and the acoustic wave front; and other parameters. The measurements were made under various ambient conditions by repeated triggering of an

explosion on the model test stand, the design and operating principle of which are described in detail. 23 figs, 9 tables, 34 refs. (RZh)

c. FIRE AND EXPLOSION HAZARDS OF MATERIALS

1997. Smith P
POLYURETHANE FOAM FIRE HAZARDS
Fire Eng J; 36(104):40-41, 1976

A concise review is given of the fire hazards of polyurethane foam as they relate to industrial use, where large quantities are found in an uncovered state, and applied (particularly domestic) use, as upholstery fillings, laminated clothing, footwear, carpet backing, etc. The test program of the British Rubber Manufacturers Assoc to try to assess the fire hazards of this product and the findings in terms of ignition, spontaneous combustion, fire spread, burn rate of bedding, smoke and escape times, and toxic combustion products are presented.

1998. Leonard JT and Clark RC
IGNITION OF FLAMMABLE VAPORS BY CO₂ FIRE EXTINGUISHERS
J Fire Flammability; 8(1):131-134, 1977

An apparatus is described for demonstrating the incendiary nature of discharges from the horn of a portable CO₂ fire extinguisher. The center section of the horn was enclosed in a plexiglass box containing a flammable fuel/air mixture and a grounded probe placed at a distance of 1 cm from the horn. When the fire extinguisher was discharged, sparks jumping between the horn and the grounded probe ignited the fuel vapors in the box. The purpose of the demonstration was to prove that CO₂ fire extinguishers should never be used to inert tanks containing fuel vapors. 2 figs, 4 refs. (Author)

1999. Becker W
PRACTICABILITY OF GLASS-FIBER-REINFORCED UNSATURATED POLYESTER RESIN BUILDING COMPONENTS FROM THE VIEWPOINT OF FIRE SAFETY
Kunstst; 66(12):810-814, 1976 (German)

When building materials made of glass-fiber-reinforced unsaturated polyester resins are used, the viewpoints of preventive fire protection, which all building materials are required to meet, must be taken into account. These building materials and their potential range of application are permitted on the basis of the individual provisions of state legislation and the classification given in German industrial standard DIN 4102. In exceptional cases, it may be suitable to expand the possibilities of use of these building materials if a special proof of their safety can be demonstrated by full-scale fire tests. 2 tables, 8 refs. (Fachdok 13/0334)

2000. Meckel L and Rook A
EVALUATING THE FIRE RISK OF TEXTILES
Lenzinger Ber; (40):248-257, 1976 (German; English Summary)

The problems posed by the term "clothing fire" are discussed. On the basis of fire-fatality statistics, the importance of the site of the accident, ignition source, age, and other factors relative to the evaluation of hazards

3. BEHAVIOR AND PROPERTIES OF MATERIALS

c. Fire and Explosion Hazards of Materials—Continued

is considered, the probability of the occurrence of a fire accident being compared with that of other accidents. The general evaluation of hazards by human beings, especially in connection with technological advances, is discussed. In the case of measures to avoid hazards, it is necessary to consider the extent to which the required financial and intellectual resources can be applied more effectively for the public welfare. In conclusion, after a few remarks about possible changes in the fire hazard of textiles in this century, the advantages and disadvantages of legal regulations and textile flammability labelings are discussed in brief, and the necessity of adequate consumer information, as well as the importance of advertising, are mentioned. (This paper was presented at the 14th International Chemical Fiber Conference held at Dornbirn, Austria, on 24-26 Sep 1975.) 8 tables, 14 refs. (Author)

2001. Tovey H

A STATISTICAL STUDY OF THE FIRE HAZARD OF TEXTILES

Lenzinger Ber; (40):80-86, 1976 (German; English Summary)

Described in this paper are institutional and technical systems in the USA that identify and characterize the flammability of textiles and thus help in setting priorities for textile flammability standards. Some results of statistical analyses of household fires are discussed. The paper ends with a report on the present status of international developments on textile fire statistics worked on by the Textile Committee of the International Standards Organization. (This paper was presented at the 14th International Chemical Fiber Conference held in Dornbirn, Austria, on 24-26 Sep 1975.) 4 figs, 8 tables, 12 refs. (Author)

2002. Gayduk A, Egorchenkov Yu and Lugovskoy V

PRODUCTION OF PHTHALIC ANHYDRIDE

Pozhar delo; (9):23-24, 1976 (Russian)

The conditions that promote the autoignition of precipitated resinous materials are studied, their fire-hazard properties are determined, and fire-protection steps to be taken in the production of phthalic anhydride are developed. The presence of sulphur, iron, ash, and unsaturated hydrocarbons in the original raw material (naphthalene) is responsible for the precipitation of the layered substances. A temperature control system was introduced to promote safe production conditions (a block diagram of the circuit is illustrated). Production-line fires are extinguished with nitrogen discharged from an automatic system. 1 fig. (RZh)

2003. Malitskiy V

FIRE HAZARD OF WOOL FIBER

Pozhar delo; (9):26-27, 1976 (Russian)

The hazardous properties of sheep wool are examined. Wool fiber can be easily ignited by flames from a match. Its ignition temperature is 315°C; its spontaneous ignition temperature is 465°C. Fires in wool storage areas can reach major proportions and develop very rapidly because the wool is stored in combustible bales, in combustible warehouses, and because the wool is baled in open areas without fire breaks. The main causes of fires are listed and the flame-spread conditions are examined. Wool fires are extinguished by water spray, aqueous solutions of wetting agents, and medium-expansion foam. (RZh)

2004. Mazur W

FIRES OF TANKS CONTAINING LIQUID SULFUR

Prz poz; 64(5):8-9, 1976 (Polish)

An analysis is made of the fire hazard of transporting liquid sulfur in 418 R or 402 R railroad tank cars with a polyurethane foam or mineral wool thermal insulation. Sulfur is transported in such tanks in liquid form at a temperature of 145-125°C. The possibilities of preventing and extinguishing fires in such tanks are examined. (RZh)

2005. Anon

ACTIVITIES AND POSSIBILITIES OF THE (1) FEDERAL INSTITUTE FOR MATERIALS TESTING (BAM) IN BERLIN AND THE (2) DUST RESEARCH INSTITUTE (STF) IN BONN TO INVESTIGATE THE FIRE AND EXPLOSION HAZARD OF DUSTS

Schadenprisma; 5(4):79-80, 1976 (German)

The German Federal Institute for Materials Testing (BAM) investigates the fire and explosion hazards of dusts to obtain information on the danger of a specific dust. Eight characteristics are determined. The reaction vessels used for this purpose are presented. The Dust Research Institute (STF) investigates the fire behavior of dusts by the Geigy-Kuehner method and classifies them in grades BZ 1 to BZ 6. The dusts are divided into hazard classes St0 to St3 according to the results of the dust explosion test (modified Hartmann Apparatus). Incidences of dust explosions are evaluated systematically in the documentation center. The STF also functions as a consulting agency. (Fachdok 13/0311)

2006. Wakabayashi K

FIRE AND EXPLOSION PREVENTION ENGINEERING

Soda to enso; 27(5):147-159, 1976 (Japanese)

The results of complex continuing long-range fire research on new materials, equipment, and technological processes with definite fire hazards are presented. The research is being carried out primarily at the Fire Engineering and Methods Research Institute in Tokyo. Data on the fire hazards of the kinds of woods most widely used in Japanese industry are given. It has been found that the autoignition temperature of wood with about 8% moisture content fluctuates from 350 to 420°C. Also studied were the spontaneous ignition condition of wood exposed over a long period of time to a temperature of 90-140°C and the possibility of heat accumulation. An apparatus used to artificially produce spontaneous ignition of specimens cut from commercial panels made by pressing sawdust is described. The fire hazard of these panels was found to be due to the use of a paraffin-olein emulsion as the binding agent. The emulsion consists of paraffin, oleic acid, sodium hydroxide and aluminum. The mechanism of oleic acid oxidation was studied, which is the cause of spontaneous ignition of the panel specimens when they contained more than 3% of the binding agent. 9 figs, 7 tables, 14 refs. (RZh)

2007. Durbetaki P, Tincher WC, Lloyd LR, Lowery RP, Tingle WJ and Wolfe VL, Jr

PREDICTION OF FIRE HAZARD FROM FABRICS AND BUILDING MATERIALS. Georgia Inst Technol, School

3. BEHAVIOR AND PROPERTIES OF MATERIALS

c. Fire and Explosion Hazards of Materials—Continued

Mech Eng, Atlanta, GA; GIT SME-77, 240 pages, 78 figs, 47 tables, 45 refs, Feb 1977

The program objectives of the research reported here have been to provide modeling rules and experimental data for the prediction of material ignition time under varied exposure modes and conditions, to measure ignition/destruction time and frequency, and to develop ignition criteria for thermally thick and thin materials. The specific objectives of the program are to expand previous experiments on ignition time measurements to thermally thin and thick materials, under broad exposure conditions, varied geometry, and various materials, to determine the ignition probability of thermally thin and thick materials, and to modify and extend the modeling analysis for the prediction of ignition time. The program consists of a combined experimental and analytical effort. The experimental phase consists of six tasks and is intended to describe the material response to radiative and convective (gas-flame) heating, to provide data for experimental verification of the ignition modeling analysis, to develop new ignition criteria, and to establish constitutive laws describing material interaction with relevant ignition sources. The analytical phase consists of three tasks which, coupled with the experimental tasks, are intended to provide methods of predicting pre-ignition behavior of materials exposed to ignition sources. (Author)

d. NATURE OF COMBUSTION PRODUCTS

2008. Welker RW and Wagner JP
PARTICLE SIZE AND MASS DISTRIBUTIONS OF SELECTED SMOKES. EFFECT ON IONIZATION DETECTOR RESPONSE

J Fire Flammability; 8(1):26-37, 1977

Particle size parameters are presented for various smokes — those from common plastics and a standard calibration source, punk. Sensitivity of ionization detectors to plastic smokes is shown to be a particle-size-dependent phenomenon, ie, detector sensitivity to plastic smokes decreases with increasing particle size. Factors affecting particle size and/or particle statistics, besides the nature of the combustible and combustion conditions, include relative humidity and rate of smoke generation. 4 figs, 4 tables, 5 refs. (Author)

2009. Junod TL
GASEOUS EMISSIONS AND TOXIC HAZARDS ASSOCIATED WITH PLASTICS IN FIRE SITUATIONS: A LITERATURE REVIEW. Nat Aeron and Space Admin, Lewis Res Center, Cleveland, OH; NASA TN-D-8338, 67 pages, Oct 1976
Availability: NTIS

The hazards of plastics in fire situations, the gases emitted, the factors influencing the nature of these emissions, the characteristics of toxic gases, and the results of laboratory studies are discussed. The literature pertaining to the pyrolysis and oxidation of plastics was reviewed. An effort was made to define the state of the art for determining the toxic gases emitted by plastics under fire conditions. Recommendations are made and research needs defined as a result of this review. (Author)

2010. Seader JD and Einhorn IN
SOME PHYSICAL, CHEMICAL, TOXICOLOGICAL, AND PHYSIOLOGICAL ASPECTS OF FIRE SMOKES
Combustion Symp, Internat, 16th, Proc; 1976, Aug 15-20, MIT, Cambridge, MA, pages 1423-1445, 1977
Sponsor: The Combustion Institute, Pittsburgh, PA

In many fires, effects of smoke are the chief cause of bodily injury or death. The effects include opacity, toxicity, lachrymatory irritation, and heat transfer. In order to understand and quantify these effects, extensive research is being conducted to study the physical, chemical, toxicological, and physiological aspects of fire smokes. The principal emphasis within the scope of this paper is directed toward the physics of smokes, with only brief mention of chemical aspects. An introductory survey of the toxicological and physiological aspects of smokes is also presented. Important physical aspects of smoke particulates include light scattering and absorption; particle-size distribution; and settling, sticking, and agglomeration rates. With respect to light obscuration, it is shown that the single most important variable is particulate mass concentration. The particulate optical density (POD) is shown to be bounded within two relatively narrow ranges — one for aerosols and one for carbonaceous soots. Experimental apparatus and a test protocol for determining the qualitative and quantitative nature of the intoxication syndrome resulting from smoke exposure are discussed. This methodology employs both a behavioral endpoint and animal bioassay, which includes gross physiological evaluation, in-depth physiological monitoring of vital functions, blood-gas analysis, and pathological evaluation of early dysfunction and late-developing sequelae. 12 figs, 4 tables, 81 refs. (Author)

e. PROTECTION AND MODIFICATION OF MATERIALS

2011. Hadvig S
PROTECTION WITH FIRE-RETARDANT PAINT
Brandvaern; 2(5):14-15, 17-18, 1976 (Danish; English Summary)

Experiments conducted in an old five-story building for the purpose of determining the effectiveness of protecting wooden stairwells with fire-retardant paint are described. Landings, steps, banisters, window sashes, walls and doors leading off one stairway were cleaned of the old paint and repainted with the fire-retardant paint Unitherm. Another stairway was not repainted, except for the doors leading off it. In both cases the fire sources were 40 kg spruce timber cribs in the lower landings. In the repainted stairwell total ignition took 24 min, in the unrepainted one, 12 min. In both cases the fire spread to the roof. In the first case, however, the fire in the stairwell burned out on its own and the stairway remained intact, so that it could be used when the roof fire was extinguished. In the second case the stairway was completely destroyed by the fire. The experiments demonstrated the possibility of such protection in old buildings with stairways containing wooden components. 6 figs. (RZh)

2012. Grushecky A
FIRE-RESISTANT HYDRAULIC FLUID CAN MEAN LONG PUMP LIFE
Coal Min Process; 13(8):66-67, 72, 1976

3. BEHAVIOR AND PROPERTIES OF MATERIALS

e. Protection and Modification of Materials—Continued

Based on extended testing in its Banning No. 4 mine, Republic Steel has developed a preventive maintenance program providing optimum hydraulic pump life using fire-resistant hydraulic fluids of the invert emulsion type. Up to 165,000 tons of clean coal are now being produced by continuous miners without hydraulic pump failure. The four key factors in the program, namely, 1) proper storage and handling; 2) maintaining reservoir level; 3) contamination control; and 4) periodic testing, are discussed. 8 figs. (Author)

2013. McInain L

SEEKING ALTERNATIVES TO HAZARDOUS ASBESTOS

Engineer (London); 242(6270):30-31, 34, 1976

In connection with restrictions on the use of asbestos in Sweden, owing to the risks of asbestosis, lung cancer and mesothelioma, various British companies have been approached with a request for asbestos alternatives. This interest has called for the preparation of one of the first comprehensive reports available in Britain on asbestos alternatives, soon to be released. The report examines the more important of the 1,000 applications of asbestos, eg, as fire protection materials, and assesses the alternatives. Glass-reinforced plastic is the most common alternative, but does not have the fire-resistance properties of asbestos. Work has been done on metallized synthetic and ceramic fiber products for fire suits. The ceramic fiber replacements may be in spray, blanket or mat form and are generally superior to asbestos in fire resistance or are considered to come closest to having any chance of success. The various types of ceramic fibers are discussed. 6 photos.

2014. Abbott NJ and Schulman S

PROTECTION FROM FIRE: NONFLAMMABLE CLOTHING — A REVIEW

Fire Technol; 12(3):204-218, 1976

Fiber, such as Durette (modified Nomex), Rhovel (a polyvinyl chloride), polyimide fibers, HT-4 (an aramid), and PBI (modified polybenzimidazole) with limiting oxygen index values of 35 to 40 are considered to be truly nonflammable, even under fairly extreme conditions, but are of interest for specialized applications where the need justifies the cost. The insulating value of protective clothing must be sufficient to prevent skin burns by heat transfer. The requirements of nonflammability, insulation, and heat reflection tend to make the protective garment heavy, bulky, and stiff, which may be acceptable to firefighters. 10 figs, 1 table, 14 refs. (NFPA)

2015. Breu R

PALUSOL FIRE-RESISTANT SHEETS IN LABORATORY CONSTRUCTION

GIT; 21(1):30-33, 1977 (German)

The flexible Palusol sheets (about 2 mm thick) consist of aqueous sodium silicate containing fiberglass and have a layer of epoxy resin on each side. Above 100°C (that is, in case of fire) a thermally insulating, pressure-resistant foam sheet is formed, increasing in thickness, even when shielded, resulting in an insulating and barrier layer to retard the transmission of heat and to prevent the penetration of flame and air to the protected parts. These sheets

have already been used successfully in laboratories. Some of the ways in which these sheets can be used are as follows: pipe sheathing; laboratory cabinets; containers; wooden doors; sound-, smoke-, and fire-proofing doors; glazed fireproofed doors; vent sheathings; ventilator sheets; furniture for documents; sheathings for steel cylinders; and ceiling and wall penetrations for utilities. 5 figs. (Fachdok 13/0464)

2016. Bonsignore PV and Levendusky TL

ALUMINA TRIHYDRATE AS A FLAME RETARDANT AND SMOKE SUPPRESSIVE FILLER IN RIGID HIGH DENSITY POLYURETHANE FOAMS

J Fire Flammability; 8(1):95-114, 1977

Alumina trihydrate introduced into rigid high-density polyurethane foam can significantly improve its burn resistance as measured by oxygen index, UL94 rating, and vertical burn rate. Incorporation of the hydrate in the foam system by predispersion in the polyol component can present difficulties because of the viscosity-building effect of the dispersed hydrate. Dimethyl methylphosphonate (DMMP) has been found to be a valuable adjunct to hydrate for lowering hydrate/polyol dispersion viscosities while improving burn resistance of the resulting composite foam. At equivalent oxygen index, hydrate-extended foams show lower smoke development than does a commercial UL94 V-1 rated foam. DMMP causes significant increases in smoke development in these compositions. 8 figs, 9 tables, 10 refs. (Author)

2017. Pogorzelski JA

FIRE PROTECTION OF METAL STRUCTURES. SURVEY OF WAYS AND MEANS

Prz Bud; 48(5):220-223, 1976 (Polish)

The general problems involved in increasing the fire endurance of metal building structures and the fire retardants produced in Poland are examined, such as Ognikolor intumescent paints, laminated materials, and sprayed fire-resistive heat-insulating coatings of slag concrete and cement solutions. 5 figs, 10 refs. (RZh)

2018. Jones IP and McCartan DA

FLAME RESISTANT BUILDING MATERIAL

US Patent No. 3,955,031; C1 428/288, (B32B 17/10), Appl 4 Feb 1974, Discl. 4 May 1976, Assignee: Owens-Corning Fiberglas Corp, Toledo, OH

Building materials of the type containing an impermeable membrane, as, for example, an insulation material, or a wallboard, or ceiling tile, are provided. The impermeable membrane is first formed upon a sheet of paper that gives structured rigidity to the membrane, and is then used as an adhesive to hold the paper onto a porous body by heating the membrane to a softened condition and pressing it against the porous body. The membrane is preferably made in two steps, wherein a first application of a thermoplastic latex is put on the paper and then a second application of latex is applied to seal pores in the film produced by the first application of latex. A fire retardant, ie, either a flame-retardant salt in the paper or a halogen-liberating resin coating on the outside surface, is provided to liberate flame-extinguishing gases to be held in place by the vapor barrier. In the most preferred embodiments, a halogen-containing ther-

3. BEHAVIOR AND PROPERTIES OF MATERIALS

e. Protection and Modification of Materials—Continued

moplastic resin is used as at least part of the material forming the vapor barrier and either another coating of a halogen-containing resin is applied to the outside surface of the paper, or a flame-retarding salt is included in the paper to produce a building material whose surface has an exceedingly low flame propagation rate. 2 claims, 4 drawing figs. (Author)

f. STABILITY OF MATERIALS AT ELEVATED TEMPERATURES

2019. Abeles PW, Bardhan-Roy BK and Turner FH
PRESTRESSED CONCRETE DESIGNERS' HANDBOOK
Cement and Concrete Assoc, London, UK; 2nd edit, 548 pages, 1976

This second edition of the handbook includes a number of new examples of precast members (double T-beams). Special problems on the use of lightweight concrete and fire resistance of precast concrete are also investigated. International metric notation has been used almost completely for this edition. Most of the material from the first edition has been expanded, including chapters on materials and structures, based on research results established since the first edition of 1962. A new chapter has been added on criteria for analysis and design based on the new conditions of limit-state design which have been introduced. Chapters on losses of prestressing force, analysis of stresses, general design of prestressed members, examples of flexural design, end blocks, composite members, deflection, other design considerations, statistically indeterminant structures, applications of prestressing, and design of fire resistance have been expanded and carried over from the first edition. Design charts with notes on additional data are included. Examples are given in English, as well as SI metric and kilogrammetric units.

2020. Lie TT and Stanzak WW
STRUCTURAL STEEL AND FIRE — MORE REALISTIC ANALYSIS
Eng J; 13(2):35-42, 1976

Following a brief review of the present technology for calculating the fire resistance of steel building elements, means for using the results under other conditions of fire severity in order to reduce the number of standard, destructive fire tests required for structural elements and to eliminate the need for *in situ* fire tests that would be costly as well as impractical, are presented. 12 figs, 3 tables, 22 refs.

2021. Zhukova NE and Konyuchenko VS
STUDY OF THE THERMAL STABILITY OF SEALANTS FOR MINE DEGASSING PIPE SYSTEMS
Gornospasat delo; (13):24-27, 1976 (Russian)

Results are given for tests of the combustibility and thermal stability of asbestos sealants at temperatures of 400-800°C, which are the temperatures reached during fires. It is found that the LA-1 asbestos-steel sheet (standard GOST 12856-67) has the best heat-resistant properties at high temperatures. (RZh)

4. FIRE MODELING AND TEST BURNS

a. FIELD EVALUATION

2022. Takita M and Hushiya S
FIRE FIGHTING IN A MOVING TRAIN
Tetsudo Gijutsu Kenkyu Shiryo; 33(5):167-173, 1976 (Japanese)

A detailed description is given of a method and results of research aimed at determining the conditions of fire outbreak and development in trains. A special set of cars was used for this purpose, consisting of an electric locomotive and five coaches. A fire was set in one of them; the rest were used to house various monitoring and measuring equipment and observers. Fires were set on several occasions (the studies continued for 2 months). The following conditions and parameters were varied: time of day, atmospheric and meteorological factors, location of the fire, speed of the train, degree and nature of the fire load in the fire car, and other parameters. Two movie cameras and two TV cameras were fixed to the cars adjacent to the fire car by means of external retractable brackets, making it possible to display the process of fire development on the monitor screens in the cars equipped as a laboratory and also to record the data in real time. A diagram is given of the location of the chromel-kopel thermocouples inside and outside the fire car, which were used to determine and record the temperature conditions in all stages of fire development. The research results are presented in graphic form and will be used to work up recommendations on increasing the effectiveness of firefighting in a moving train. 10 figs, 2 tables, 6 refs. (RZh)

2023. Richards RC and Vorthman RG
FULL SCALE SHIP'S HULL EXPOSURE FIRE TESTS.
Coast Guard Res and Dev Center, Groton, CT; CGR DC-14-76, USCG D-97-76, 46 pages, Jun 1976
Availability: NTIS AD-A032 867/4GA

Fourteen hundred square feet of the hull of the *MV RHODE ISLAND* were exposed to two JP-5 fires located close to the aft starboard side in order to determine the rate of heat transfer to a steel-hulled vessel. During the first fire test a water spray system producing an application rate of 0.12 gal/min/ft² was employed. The tests were analyzed to predict the results of similar fires on an aluminum-hulled vessel. The heat transfer rate to the steel hull ranged from 35000 to 45000 BTU/hr. The water spray limited the initial rate of temperature buildup, but its overall effect could not be quantified because of nonuniform water application. The predicted effects of a similar fire on an aluminum hull would be disastrous. (Author)

b. FIRE TESTING, STRUCTURES

2024. Quigg PS and Orals DL
COMMUNICATION CABLE "POKE THRU" FLOOR FIRE TEST
Build Stand; 46(2):44-51, 1977

Numerous methods have been used for sealing penetrations in walls and floors through which pipes, conduits, electrical wiring, and communication cables pass. Many

4. FIRE MODELING AND TEST BURNS

b. Fire Testing, Structures—Continued

of these methods have limitations because they are either too costly, difficult to install, or marginally effective in stopping a passage of smoke or flame from room to room or floor to floor. Sealing with a portland cement concrete provides an excellent fire barrier. However, it is extremely difficult to install and almost impossible to remove without damaging cable or conduit. Gypsum concrete used in place of portland cement concrete provides excellent fire protection and can be removed relatively easily, but it is also difficult to install. The least expensive, from a materials and installation cost standpoint, and yet very effective in containing fire and smoke, is Thermafiber mineral fiber insulation. This, in combination with granular gypsum in a sheet metal retainer, also provides excellent fire containment and added advantage of a seal to prevent flooding or cascading of water from floor to floor in the event of accidental spillage or leakage. A two-component, silicone elastomer foam is available from the Dow Chemical Company which, when mixed and inserted in an opening, will expand to effectively seal against the passage of fire, smoke and water. However, the silicone foam is much more expensive than any of the other materials and procedures already described. All of the above materials and methods were incorporated in a fire test assembly simulating a floor condition with cables passing through penetrations of various shapes. The procedure, observations, data and conclusions relative to this test are covered in the report. 15 figs, 5 photos.

2025. Anon

AN UNUSUAL FIRE*Cement (Amsterdam)*; 27(4):135-140, 1976 (Dutch)

A building specially made from prefabricated concrete elements was subjected to a fire test in Zwijnaarde, Belgium, in order to check the practical requirements against real-fire conditions, which are not yet completely understood. The experimental setup and conditions are described.

2026. San Miguel A

BASELINE DATA FROM AN A-4 COCKPIT IN SIMULATED CARRIER DECK FIRE. Nav Wpns Center, China Lake, CA; NWC TP-5812, 145 pages, Aug 1976
Availability: NTIS AD-A034 217/0GA

This report describes a study that was designed to gather fundamental data on the survivability of an aircraft cockpit in a carrier deck fire, on the characteristics of cockpit structural degradation in the fire, and on various interacting mechanisms that reduce a pilot's functionality. An unarmed Navy A-4 cockpit was subjected to a simulated carrier deck pool fire. The cockpit was instrumented with transducers to measure temperature, heat, smoke, toxic gases, light, shock, sound, pressure, and physiological behavior of rats and mice. A number of appendixes to the report give detailed descriptions of the various measuring systems and the data they produced. In addition to providing much immediately useful data, the test yielded a good base of data on which to design future tests of this kind. (Author)

c. MODELING AND SCALING

2027. Lesse PF

MATHEMATICAL SIMULATION OF A FULL SCALE FIRE TEST*Fire Prev Sci Technol*; (16):23-27, 1977

Theoretical knowledge of the physical processes occurring in a room on fire was pioneered by Kawagoe, Sekine, and Odeen. These workers developed mathematical models predicting the changes of temperature during fire in an enclosure, and their models have been subsequently refined and extended to cover the complete process of fire development. In the papers cited, experimental results were used to verify the theory and the underlying assumptions. In the present paper this theory is used as a basis of explaining the temperature-time curves of some experiments carried out independently by the Experimental Building Station, Sydney, Australia, a few years ago. The practical value of the theory in its present form is demonstrated for predicting the outcome of experiments or for their design and planning. 4 figs, 1 table, 7 refs. (Author)

2028. Hirst R, Farenden PJ and Simmons RF

THE EXTINCTION OF FIRES IN AIRCRAFT JET ENGINES. PART I, SMALL-SCALE SIMULATION OF FIRES*Fire Technol*; 12(4):266-275, 289, 1976

In simulated aircraft engine fires in a small wind tunnel, the concentration of methyl bromide required for extinction was examined as a function of the experimental variables. A burning pool of fuel and a thin film of fuel flowing over a heated surface required the same concentrations of methyl bromide to extinguish the flame at a given air velocity. In contrast, spray fires needed a much lower concentration of methyl bromide than the other two modes of combustion. A pool of fuel burning behind an obstruction is the most difficult fire to extinguish, and thus the concentration of methyl bromide required for this condition will extinguish any other fire. 5 figs. (NFPA)

2029. Beyreis JR and Skjordahl JW

A FLAME SPREAD AND SMOKE TEST FOR COMMUNICATION CABLE*Lab Data*; 8(1):15-19, 1977

A test method to characterize flame spread and smoke production of cables has been developed, and a classification scheme for grouping and reporting the test results is proposed. The method uses a 25 ft tunnel as the test facility and is similar to American Society for Testing and Materials (ASTM) E-84, with the exceptions that a cable rack is used for mounting the samples in the upper part of the tunnel and the test time has been extended to 20 minutes. (This information was presented at the 25th International Wire and Cable Symposium held on Nov 18, 1976, at Cherry Hill, N.J.) 6 figs, 3 refs. (Author)

2030. Reeves JB and MacArthur CD

DAYTON AIRCRAFT CABIN FIRE MODEL. VOL 1. BASIC MATHEMATICAL MODEL. Dayton Univ Ohio Res Inst; FAA RD-76-120-1, 141 pages, Jun 1976

Availability: NTIS AD-A033 682/6GA

A basic mathematical model and computer simulation program have been developed to assess the smoke and

4. FIRE MODELING AND TEST BURNS

c. Modeling and Scaling—Continued

toxic gas emissions resulting from the burning of cabin interior materials of a wide-body transport aircraft in a full-scale fire based on laboratory test data on these materials. The mathematical model employs a technique of approximating the distribution of burning or smoldering regions on combustible materials by dividing the surface of the material into square area elements. The combustion behavior of a material is modeled by allowing the area elements to exist in one of seven discrete states. The four primary states are the following: virgin (the original, unignited condition); smoldering (nonflaming thermal degradation); flaming (burning with open flaming); or charred (burned-out or inert). The other three states are intermediate states in the transition to or from one of the four primary states. Fire ignition; flame spread; release of heat, smoke and toxic combustion products; and the eventual extinction of a fire are all predicted by specifying times of transition between the four primary states and by specifying flame spread rates. Transition times, flame spread rates and the smoke, heat, and toxic gas release rates are assumed to be known as functions of imposed heat flux from laboratory measurements on the specific materials and assemblies of an aircraft cabin interior. Smoke and toxic gas concentration within the cabin section of the fire origin are computed by a one-dimensional, dynamic, stratified model of the cabin atmosphere, which includes buoyancy-driven flow out of the cabin section through one or more doorways. The results of two sample runs of the simulation program are presented and analyzed. (See also Vol 2, AD-A033 683 and Vol 3, AD-A033 989.) (Author)

2031. Reeves JB

DAYTON AIRCRAFT CABIN FIRE MODEL. VOL 2. LABORATORY TEST PROGRAM. Dayton Univ Ohio Res Inst; FAA RD-76-120-2, 269 pages, Jun 1976
Availability: NTIS AD-A033 683/4GA

A basic mathematical model and computer simulation program have been developed to assess the smoke and toxic gas emissions resulting from the burning of cabin interior materials of a wide-body transport aircraft in a full-scale cabin fire. The simulation is based on laboratory test data on the cabin materials. This report presents the results of a laboratory test program that was conducted in support of the model development. Various flammability and combustion toxicity properties were measured for several wide-body cabin materials by the Boeing Commercial Airplane Company under a subcontract to the University of Dayton Research Institute. The measurements were made using the OSU Combustion Analyzer, the NBS Smoke Chamber, and the Boeing Burn-Through Apparatus. This report describes the test procedures, the test results, the analysis of the test data, and the development of a set of material properties input data for the cabin fire simulation program. This report consists of three volumes: Volume I is entitled "Basic Mathematical Model" and Volume III is entitled "Computer Program User's Guide." (See also Vol 1, AD-A033 682 and Vol 3, AD-A033 989.) (Author)

2032. Kahut PM

DAYTON AIRCRAFT CABIN FIRE MODEL. VOL 3. COMPUTER PROGRAM USER'S GUIDE. Dayton Univ Ohio Res Inst; FAA RD-76-120-3, 52 pages, Jun 1976
Availability: NTIS AD-A033 989/5GA

A basic mathematical model and computer simulation program have been developed to assess the smoke and toxic gas emissions resulting from the burning of cabin interior materials of a wide-body transport aircraft in a full-scale fire. The simulation is based on laboratory test data on the cabin materials. This report is a guide for use of the computer simulation program, which includes instructions for input data preparation, sample input and output, basic definitions concerning the simulation program and mathematical model, and a brief description of the program structure. (See also AD-A033 682 for Vol 1 and AD-A033 683 for Vol 2.) (Author)

2033. Muller FA

A COMPUTER PROGRAM TO MODEL THE DYNAMIC THERMAL BEHAVIOR OF A NUCLEAR WARHEAD SECTION ADAPTION KIT IN AN ACCIDENTAL FIRE ENVIRONMENT. Picatinny Arsenal, Dover, NJ; PA TR-5015, 59 pages, Dec 1976
Availability: NTIS AD-A034 894/6GA

A method for modeling the thermal behavior of a warhead section adaption kit in an accidental fire environment has been described in detail. A Control Data Corporation Model 6600 computer operating under SCOPE version 3.4.2 and utilizing the dynamic simulator called CSSL 3 is used. The model permits study of the temperature versus time of a few points within a three-dimensional system. The effects of radiation, conduction, and convection are included, as well as changes in heat paths due to melting of some parts. (Author)

2034. Brown LE, Martinsen WE, Muhlenkamp SP and Puckett GL

SMALL SCALE TESTS ON CONTROL METHODS FOR SOME LIQUEFIED NATURAL GAS HAZARDS. Univ Engrs Inc, Norman, OK; UE-308-FR, USCG D-95-76, 80 pages, May 1976
Availability: NTIS AD-A033 522/4GA

A report of results of small scale (100 square ft) tests of some liquefied natural gas (LNG) hazard control methods and concepts is made. Tests were run to estimate dry chemical flow rate requirements for the extinguishment of fires from LNG pools with obstructions in the pool area and fires from LNG pools on water in a containment. Objectives were to obtain data for design of large-scale tests. Other small-scale tests examined the feasibility of other concepts for controlling hazards from spills of liquefied natural gas. Agent application rates required for extinguishment of obstructed LNG fires and LNG fires on water are not different from those effective on unobstructed fires on dry surfaces (if the functionality between burning rate and application rate is accounted for). Care must be exercised to assure uniform powder distribution on obstructed fires. Tests of water spray screens to reduce downwind vapor concentrations showed that the concept is practical and effective for small LNG spills, and that the mechanism of reduction is the addition of turbulence in the vapor zone. Tests of water spray screens to reduce radiant heating of exposures demonstrated no practical value for the concept except as an uneconomical alternative where spray directly on the exposure is not possible. (Author)

4 FIRE MODELING AND TEST BURNS

c. Modeling and Scaling—Continued

2035. Ku AC, Doria ML and Lloyd JR
NUMERICAL MODELING OF UNSTEADY BUOYANT FLOWS

Combustion Symp, Internat, 16th, Proc; 1976, Aug 15-20, MIT, Cambridge, MA, pages 1373-1384, 1977

Sponsor: The Combustion Institute, Pittsburgh, PA

A numerical model for the prediction of unsteady, two-dimensional buoyant flows is presented. The model makes use of the full elliptic balance equations for heat, mass, and momentum and allows for full coupling between density and temperature. The model is highly flexible in that it can accommodate variable transport properties and complex boundary conditions. Of particular importance, it is capable of treating surfaces such as a doorway or window across which there can be a free inflow or outflow of fluid to the computational region. The model has been used to predict the time-dependent velocity and temperature fields generated by fire in an enclosure or corridor. It has proven successful in predicting the gas velocities and temperatures generated by the fire in the enclosure corridor geometries, the ventilation of the fire through windows or doorways, and the heat transfer rates to the various surfaces involved. In these cases combustion is modeled by volumetric heat sources. The results for two particular cases are presented and comparisons are made with experiment. 7 figs, 12 refs. (Author)

2036. Williamson RB

FIRE PERFORMANCE UNDER FULL SCALE CONDITIONS — A STATE TRANSITION MODEL

Combustion Symp, Internat, 16th, Proc; 1976, Aug 15-20, MIT, Cambridge, MA, pages 1357-1371, 1977

Sponsor: The Combustion Institute, Pittsburgh, PA

This paper concerns the measurement of fire performance under experimental fire conditions resembling actual fire conditions. A new method of analyzing and reporting the results of these experiments, a State Transition Model, is introduced. Distinct states are chosen for the analysis of fire growth experiments, and their duration provides a new experimental data. Three pre-flashover states are defined as follows: 1) J = the period of time from the beginning of the experiment to ignition of the specimen; 2) K = the period of time from ignition of the specimen until flames touch the ceiling; and 3) L = the period of time from when the flames first touch the ceiling until full involvement (flashover) occurs. These states are components of the State Transition Model, and histograms and cumulative distribution functions (CDF) of the state durations then provide a graphical representation of fire performance. Examples are chosen to illustrate the method. Traditional cellulosic and cementitious walls and ceilings are compared to plastic materials in the same configuration. 8 figs, 2 tables, 10 refs. (Author)

d. SYSTEMS BEHAVIOR

2037. Abrams MS

FIRE TEST OF FLOOR OR ROOF ASSEMBLY WITH I/D COMPONENTS. Portland Cement Assoc, Skokie, IL; R/D Bull No. RD 040.01B, 8 pages, 1976

A report is made on a fire test of a floor or roof assembly consisting of a reinforced concrete pan-joint slab made with components of the registered trademark system

"I/D" and a 5/8 inch gypsum-board ceiling. The purpose was to establish the fire-resistance classification for the assembly by a fire test conducted in accordance with ASTM E 119, "Standard Methods of Fire Tests of Building Construction and Materials." From data obtained, all ASTM E 119 endpoint criteria were met for the 2-hour fire-endurance classification. (Author)

5. FIRE PROTECTION PRINCIPLES

a. BUILDING DESIGN AND CONSTRUCTION PRINCIPLES

2038. Raes H

THE INFLUENCE OF A BUILDING'S CONSTRUCTION AND FIRELOAD ON THE INTENSITY AND DURATION OF A FIRE

Fire Prev Sci Technol; (16):4-16, 1977

A rational and appropriate choice of the periods of fire-resistance for the various elements in a building structure is of great economic importance in view of the cost of fire protection and the cost of reinstating the building in the event of a fire. In a technical study entitled "Evaluation of Fire Risk," the various factors involved were discussed, including the building's fire load, physical features and the area of the ventilation openings. This information has been summarized also in our study on fire loads (January 1975), which was part of the national fire research program financed by IRSIA (Institute for the Encouragement of Scientific Research for Industry and Agriculture). In the present study the factors determining the intensity and duration of a fire are considered, since these factors are of major importance when deciding on the fire protection requirements for a building. In a fire, the combustion rate may be controlled by the surface area of the fuel in contact with air or by a ventilation factor related to the surface area and the height of the windows. The relationship is discussed between a real fire and the standard temperature-time curve and, for fires controlled by ventilation, equations are given for the equivalent duration of real fires. Many studies are described of fire load densities in actual offices, educational buildings and hospitals. (This article was originally published in *Rev Belge du Feu*, No. 31, 1976.) 16 figs, 10 tables, 23 refs. (Author)

2039. Harmathy TZ

DESIGN OF BUILDINGS FOR LIFE SAFETY — PART II

Fire Technol; 12(3):219-236, 1976

The destructive potential in a fire cell (space on fire) may be minimized by proper dimensioning of the compartment (large windows and low ceiling). Fire isolation may be accomplished by self-closing doors, continuous balconies, open corridors, and flame deflectors on windows. For the drainage method, applicable to poorly compartmented highrise buildings, the energy of the fire is exploited by drawing air into the fire cell in quantities that produce a fuel-surface-controlled condition, ie, short duration at relatively low temperatures, also by maintaining pressure in the fire cell below the pressure in neighboring spaces, and by removing flames and smoke from the fire

FIRE TECHNOLOGY ABSTRACTS

5. FIRE PROTECTION PRINCIPLES

a. Building Design and Construction Principles—Continued

cell. (For part I see *FTA*, 1(4), Abstract 1244.) 16 figs, 20 refs. (NFPA)

2040. Buerger A

PREVENTIVE FIRE PROTECTION FROM THE VIEW-POINT OF A FIREFIGHTER AND ARCHITECT

Oesterr Feuerwehr; 30(12):225-226, 228-229, 1976 (German)

This paper was presented at a seminar of the Isavolta Company. It deals with the status of preventive fire protection in the Federal Republic of Germany (FRG). The legal background consists of a set of 1,187 laws, ordinances and codes (compiled in eight volumes published by the Association for the Advancement of Fire Protection in Germany (VFDB)). But the increasing fire loss figures show that there are still many shortcomings, such as lack of uniformity within the FRG owing to the federative system, deficient fire-protection research and public education in many western industrial countries. The author takes advantage of this seminar to disclose his views on the "Thermax fire-protection panel" being manufactured by the company that sponsored the seminar. Suggestions are made as to how preventive fire protection on the national and international levels can be made more effective. 2 figs. (Fachdok 13/0322)

2041. Spiegelhalter F

GUIDE TO DESIGN OF CAVITY BARRIERS AND FIRE STOPS. Fire Res Sta (UK), John Laing Res and Dev Ltd, Borehamwood, Hertfordshire; BRE CP-7-77, 24 pages, 14 figs, 16 plates, Feb 1977

Consequent to a number of fire incidents in which the spread of fire was apparently assisted by the presence of cavities within structural elements and roof spaces, the Building Regulations 1976 introduced a requirement for the provision of cavity barriers. Architects and designers do not at present have a great deal of information on the availability of suitable materials and the methods of design. In order to be able to provide a technical base, John Laing Research and Development Ltd was asked to undertake an extramural investigation of the practical problems involved in choosing appropriate materials and to consider the methods of fabricating and erecting cavity barriers in a number of typical building situations. The present publication is the outcome of this activity and includes additional information on fire stops, as well. It is not to be regarded as a set of solutions that have a "deemed to satisfy" status, but mainly as a starting point for the initial design. The work was carried out under contract to the Fire Research Station, to whom all queries arising from this paper should be addressed. (Author)

b. DETECTION AND ALARM EQUIPMENT

2042. Drax H (Ed)

HOW RELIABLE ARE AUTOMATIC FIRE ALARM SYSTEMS — CONCLUSIONS FROM AN ANALYSIS OF FALSE ALARMS IN THE BREMEN CONTAINER TERMINAL

Bremen Professional Fire Dept, FRG; 64 pages, 1976 (German)

The report begins with a general review of the different kinds of fire detectors. The use and operating principle

of fire detectors, as well as some observations on false alarms, are briefly outlined, followed by a discussion of the tasks of fire-alarm centers. The premises to be examined are described to the extent necessary for an understanding of the report. The records of the Bremen Professional Fire Department (FRG) are used to analyze the false alarms. The pros and cons of a number of causes of false alarms and corrective measures are given. An attempt is made to find solutions to eliminate false alarms in the premises being considered. 35 figs, 3 tables, 11 refs. (Fachdok 13/0340)

2043. Schaffernak AF

MODULAR CONTROL STATION TECHNOLOGY FOR FIRE ALARM SYSTEMS

Elektro Anz; 29(6):5 pages (special issue), 1976 (German)

Modern fire alarm systems that are designed to provide extensive protection of human life and property have very complex control functions to solve and require the initiation of alarm signals in special types of plants. Four principal tasks are imposed on a modern control station: 1) reliable evaluation of detector signals; 2) measures to ensure life and property safety; 3) actuation of the extinguishing system and associated steps; and 4) monitoring of the operation of the extinguishing system and subsequent actions. A novel design meets these requirements by applying the most modern switching techniques. Four basic modules (linear, indication, standby current supervision, and short-circuit monitoring) with specific fire alarm functions are combined with an electronic control system containing over 40 different components that assumes the signal processing functions. 8 figs, 6 refs. (Fachdok 13/0393)

2044. Eicker H

DEVELOPMENT OF NOVEL CH₄ AND CO MEASUREMENT INSTRUMENTS

Glueckauf; 112(20):1162-1163, 1976 (German)

Remote-sensing, intrinsically safe, fixed CH₄ measuring instruments based on infrared methane absorption and multiple measuring devices with intrinsically safe pickups based on the heat-of-reaction measurement principle are presently being developed by the Mining Research Company of the FRG (Bergbau Forschung GmbH). Portable CH₄ indicators based on the heat-of-reaction principle (indicator range of 0-2.5% CH₄) are undergoing qualification tests (Auergesellschaft and Draegerwerk). A new hand-held CH₄ indicator of the Auergesellschaft (indicator range of 0-100% CH₄) based on the heat-of-reaction principle has already been licensed. A device with an electrochemical analyzer is being developed by the AEG to monitor the CO content. The so-called metal-oxide detectors, whose electrical conductivity changes as a function of the CO content of the mine damp, can also be considered as additional primary elements for the construction of CO measurement devices. 5 refs. (Fachdok 13/0171)

2045. Koval'chuk VI, Bushuev VV and Dubin GM REMOTE AUTOMATIC EXTRACTION OF MINE DAMP SAMPLES FROM THE ATMOSPHERE OF FIRE AREAS USING COMPOUND PIPE SYSTEMS

Gorn elektromekh i avtomatika. Resp mezhved temat nauch-tekh sb; (28):41-43, 1976 (Russian)

5. FIRE PROTECTION PRINCIPLES

b. Detection and Alarm Equipment—Continued

The conditions of automatic extraction of mine-damp samples in emergency situations using the UE-1 ejector system are examined. A method of engineering calculation of compound piping systems is described, and an analysis is made of the results. 1 fig, 2 tables, 5 refs. (RZh)

2046. Al'perovich VYa, Koshovskiy BI and Zaborskaya AN

CHROMATOGRAPHIC ANALYSIS OF ETHYLENE AND ACETYLENE MICRO-ADMIXTURES IN FIRE GASES
Gornospasat delo; (13):21-24, 1976 (Russian)

The gas circuit of a chromatograph with multiple concentration of the sample is proposed, along with a method of analyzing ethylene and acetylene, which are indicator gases in incipient endogenous fires. (RZh)

2047. Anon

AIR SAMPLING DETECTOR SNIFFS OUT FIRES IN UNMANNED AREAS

Iron Steel Eng; 53(6):69, 1976

The measures taken by a rolling mill management to protect unattended machines operating over wide areas are described. The prime measure taken was to introduce the Kidde Atmo and ionization detection systems, the operating principles and performance of which are discussed. 2 figs.

2048. Heskestad G

ESCAPE POTENTIALS FROM APARTMENTS PROTECTED BY FIRE DETECTORS IN HIGHRISE BUILDINGS

Kasai; 26(1):66-68, 1976 (Japanese)

The electric circuit, structure, characteristics and operating principle of an all-purpose fixed fire protection system, which was developed in 1975 and has been proposed for mass production, are described. The system is multi-functional and serves the following purposes: automatic maintenance of temperature in a premise by means of a heat regulator; air conditioning; intake-exhaust ventilation; fire detection; automatic reporting of the outbreak of fire to the municipal fire control center over a low-current telephone network; removal of the smoke generated during a fire; and fire suppression by several automatically actuated foam extinguishers. The system is designed for private apartments and is characterized by relatively low cost and low power requirements. A stand for testing the system is described and graphic data illustrating its operating characteristics under various conditions are given. The system includes three types of detectors: heat, smoke and photoelectric. 4 figs. (RZh)

2049. Tato H

FIRE DETECTORS

Kuki tyowa to reito; 16(8):107-129, 1976 (Japanese)

A description is given of the design, circuitry, and principal tactical and technical parameters of some new types of mass-produced Japanese fire detectors and various monitoring and measurement instruments used either independently or in combination with the fire system equipment. It is pointed out that the latest series of S25C fire detectors differs from the preceding versions in the broader range of climatic conditions under which they can be used: from -30 to $+72^{\circ}\text{C}$, with a relative humidity

limit of 98%. Also described is a universal contact thermoregulator with a magnetic head and a working range of 0 to 690°C . The indicator contains two main assemblies: the fire detector and temperature indicator assemblies, and also a compact electromagnetic lead for connection to any kind of actuator device or to the control element of a system used in conjunction with the given thermoregulator. Overall and installation dimensions are stated for all the devices. 26 figs, 11 tables. (RZh)

2050. Anon

PHOTOELECTRIC FIRE DETECTOR

Kuki tyowa to reito; 16(7):150-151, 1976 (Japanese)

The design, technical specifications, tactical characteristics, and instructions for the use of a photoelectric detector of the NLD-18 model, which reacts to an ionized smoke atmosphere and is designed for operation either in conjunction with complex automatic fire detection and extinguishing systems or independently, are described. The main component of the detector is a sensitive silicon photodiode with a near-linear characteristic. The distinctive feature of the detector is its comparatively small size (109 mm diameter, 60 mm height; 240 g weight). The allowable ambient temperature range is -10 to 50°C . Power is from an 18-V d-c net. In the duty mode the detector does not require more than 100 mA current. It is designed for operation in a network made up of several such series-connected detectors. For this purpose the detector circuit provides for 4-lead connection to the net: 2 leads for connection to the input of the receiver which initiates the visual and acoustic alarm when the current amplitude on the detector circuit rises, and 2 leads for connection to the next detector. The installation and adjustment methods are described in detail. 4 figs, 1 table. (RZh)

2051. Anon

THE NID-480 SMOKE DETECTOR

Kuki tyowa to reito; 16(7):143-149, 1976 (Japanese)

A description is given of the design and operating principle of the Japanese NID-480 smoke detector and of its tactical characteristics and technical specifications, as well as of the results of laboratory tests. The detector is 120 mm in diameter, 55 mm in height, and weighs 150 g. It reacts to ionization of the atmosphere of an enclosure in which it is installed, changing the output control voltage in the range of 14.5 to 35 V. The detector is supplied from a primary or secondary (rectifier) d-c source ($+24\text{V}$) with maximum current in the supply circuit of 100 mA. The operating temperature range is -10 to $+50^{\circ}\text{C}$. The detector is designed for operation in conjunction with a broad range of fire-protection equipment and applications, from private apartments to complex automatic fire detection and extinguishing systems used in office and public buildings and in large industrial plants of various branches of industry. The laboratory test stand on which the operating parameters were tested is described. 8 figs, 3 tables. (RZh)

2052. Anon

NEW SHIP FIRE ALARM SYSTEM FROM UME MARINE

New Ships/Neubauten; 21(7/8):167-168, 1976 (German)

5. FIRE PROTECTION PRINCIPLES

b. Detection and Alarm Equipment—Continued

The KBAR 600 fire alarm central from UME MARINE (FRG) is a modern, fully electronic system. The individual loop modules are provided with signals for interruptions and alarms. The central is suitable for any language by using symbols. In order to monitor the loop modules as well as the associated signal and alarm units, a separate test sector has been included that can simulate every operating and error state for each individual loop. To be used with this central is the new KEA 2023 ionization detector, which, in contrast to earlier detectors, operates with 20-24 d-c voltage and indicates operating status by means of a luminous diode. 2 figs.

2053. Anon

THE "SIGMAGUARD" FIRE ALARM SYSTEM OF BBC-TOTAL

New Ships/Neubauten; 21(7/8):168-169, 1976 (German)

The technological potential of the Brown-Boveri Company (BBC) in the electronics field has been combined with the fire-protection expertise of TOTAL Foerstner and Co (FRG) to produce the new Sigmaguard ship fire alarm system. The Sigmaguard is a modern modular system for the construction of automatic fire-alarm systems. It consists of the central, the detectors and the signal devices. The numerous supervisory and signal tasks are concentrated in only four components: linear, optical signal control, closed-circuit supervision, and ground-leakage supervision. The components are connected with a bus-bar system to which information is transmitted or from which information is received. 1 fig.

2054. Ishikawa M

ALARM DEVICE FOR THE PREVENTION OF FIRES RESULTING FROM THE LEAKAGE OF ELECTRICITY

Ohm: denki zasshi; 63(7):109-114, 1976 (Japanese)

Described are the design, electrical circuit and operating principle of several versions of automatic alarms installed in various high-voltage industrial equipment, as well as in electrical power lines of industrial and residential communication systems designed for the detection of a fire hazard as a result of the leakage of electricity exceeding a certain predetermined threshold value. The circuit and tuning of these devices provide for two current-leakage threshold values: when the first value is exceeded, the circuit automatically generates a signal indicating an emergency situation, which is indicated on the control panel serviced by an operator; when the second value is exceeded, the circuit automatically disconnects the high voltage in the faulty portion of the communications system. The action of all the versions considered here is based on constant measurement of the resistance of the insulation. The measurement circuit contains a current generator and a magnetoelectric ratiometer with two coils, one connected as an ammeter, the other as a voltmeter between the section of insulation being monitored and the probe. The magnitude of the leakage current is measured against the resistance of the insulation, the permissible value of which is 0.5-1 megohm in all versions. 6 figs, 2 tables. (RZh)

2055. Miyaki H and Ito T

SAFETY MEASURES IN PLANTS. UNINTERRUPTED MONITORING TO ENSURE SAFETY

Puranto Enjinia; 8(7):33-38, 1976 (Japanese)

A detailed description is given of remote monitoring of the surface temperature of fire-hazardous objects using infrared devices. The OS-1 infrared monitor consists of a specular objective camera mounted on a tripod, a control panel, and a vacuum pump. The infrared image of the object under observation is projected by the specular objective onto a membrane located in a vacuum cell. The image can be observed through an ocular system and can be photographed at the same time. The instrument is capable of detecting a 0.5°C temperature differential on the object against a background of ambient room temperature. At a temperature difference of 10-20°C on the surface of the object the resolution is 10-15 graduations per mm. The time required to obtain an image is 10-20 sec. The instrument contains two small models of an absolute black body with regulatable temperature. The image of the openings of the black body cavities is projected by the infrared objective onto the surface of the membrane, making it possible to compare the infrared radiation of the object with the black-body radiation and thus to determine the radiation intensity of the object being monitored. The temperature distribution over the surface of the object can be determined with a high degree of accuracy from photographs obtained with the OS-1 instrument. It is emphasized that the fire safety of many processes can be increased appreciably with heat-sensing infrared instruments. 11 figs, 4 tables. (RZh)

2056. Simon FN and Axmark RE

SPACE CHARGE EFFECTS IN IONIZATION TYPE PARTICULATE DETECTORS

Rev Sci Instrum; 48(2):122-126, 1977

The response to particulates of an ionization chamber with adjacent unipolar and bipolar zones is analyzed. Values of reduced ion mobility from particulate charging in the unipolar zone and the resulting increase in surface recombination in the bipolar zone are determined from experimental data. A solution of the general field equation as a function of distance in parallel plate geometry is plotted. The current-voltage characteristics from the general equation is compared with that from the simpler vacuum field approximation for bipolar volumes. The close agreement warrants general use of the vacuum field in ionization chambers for the small operating current densities employed in these detectors. 8 figs, 3 refs. (Author)

2057. Humphrey R

DETECTING FIRE ON BOARD

Safety Sea Internat; (89):29-30, 32, 1976

The trend of increasing ship size and diminishing crew population makes it highly desirable not only to fulfill but to exceed the minimum statutory detection requirements. The special difficulties in ship installations, such as forced ventilation, the presence of obstructions, and ship vibration and movement, are discussed, along with the environmental test requirements for detectors (vibration, corrosion, impact, shock, and low ambient temperature). The main detection systems, including heat, optical, ionization, and radiation sensing detectors, are described, as are their control equipment and new developments in fire protection, in particular the Beam Master (laser) detection system and an improved sampling system.

5. FIRE PROTECTION PRINCIPLES

b. Detection and Alarm Equipment—Continued

2058. Meili E
FIRE DETECTION — YESTERDAY, TODAY, TOMORROW
Schadenprisma; 6(1):1-3, 1977 (German)

This paper, which was given at the 7th International Seminar on Problems of Automatic Fire Detection in Aachen, is devoted to the development of automatic fire detection from its beginnings, ie, from thermomaximum to rate-of-rise to smoke detectors. The problem of spurious alarms (environmental influences), which arose with the introduction of highly sensitive detectors, as well as false alarms triggered by system malfunctions, are the subject of present developmental efforts. Spurious alarms can be eliminated at the present time by human intervention in the alarm loop. In future designs, more "intelligent" detectors with the capability of analyzing fire characteristics, wireless systems for transmissions technology, and the introduction of microprocessors or minicomputers for control stations are conceivable. (Fachdok 13/0433)

2059. Schmalor G
TESTING FIRE ALARM SYSTEMS
Schadenprisma; 5(4):71-75, 1976 (German)

Almost all the known fire alarm systems were tested in about seven years of experience and the principal shortcomings detected during this period are listed. Since the manufacturers of fire alarms and fire-alarm systems are, by preference, familiar only with their own devices and systems, this survey of shortcomings makes it possible for them, to a certain extent, to make use of the experience gained by a third party. Recommended are system tests at a testing laboratory that is recognized by the Federal Minister for Labor and Social Order, because systems and devices that bear the Technical Control Service test label show that they are safe in every respect, that is, that they do not endanger the consumer, that they transmit signals reliably, and that their technical maintenance is simple. 1 fig, 1 table. (Fachdok 13/0310)

2060. Hoshiya S and Kita H
FIRE DETECTORS
Tetsudo Gijutsu Kenkyu Shiryo; 33(5):185-186, 1976 (Japanese)

Considered in this article are the results of experiments to detect fire in rolling stock by means of heat and smoke detectors. The smoke detector is actuated by igniting 20 sheets of newspaper in a sleeper car. In the middle of the sleeper car (where the fire was set) the fire was detected in 1 min 44 sec, in 3 min 23 sec at the exit doors, and in 4 min 39 sec near the restroom. The heat detectors were not triggered in this version of the experiments. In an experiment with a fire source consisting of 20 sheets of newspaper and 20 ml of alcohol the smoke detector was triggered. The presence of a fire in the middle of the car was detected in 57 sec, in 1 min 9 sec at the exits, and in 1 min 26 sec near the restroom. A heat detector, operating on the rate-of-rise principle, detected the fire in 29 sec, 1 min 8 sec, and 44 sec, resp. A heat detector operating on the temperature measurement principle detected the fire in 1 min 10 sec, 5 min 37 sec, and 5 min 45 sec, resp. These experiments confirmed that fire detectors used in other areas are suitable for the detection of fires in rolling stock also. 2 tables. (RZh)

2061. Esser R
MOBILE FIRE ALARM SYSTEMS
Werkfeuerverband eV. Rundschreiben; (95):12-16, 1977 (German)

It is not economically feasible to equip every single enclosed area in a large industrial complex with fire detectors or even fixed installations. But there are times when these areas are temporarily exposed to increased fire hazards, eg, during welding work. Legal regulations require greater care to be taken with regard to fire hazards in such cases, especially after the completion of welding work. Here there are many gaps in safety practices that could be filled with mobile fire detection systems. Four practical examples reveal other instances of temporary fire hazards. (Fachdok 13/0507)

2062. Ibach fnu
AUTOMATIC FIRE ALARM SYSTEMS
Werkfeuerverband eV. Rundschreiben; (95):4-11, 1977 (German)

The conversion of materials and energy that takes place in every fire yields various fire characteristics. The task of the detectors of an effective fire alarm system is to detect a certain fire characteristic at the earliest possible moment and with the greatest selectivity. The tasks and operating methods of detectors are explained. The type of detector to be installed and the performance expected of it are determined by a fire hazard analysis of the factors (1) flammability, fire load, fire spread hazard, and smoke generation (ie, nature of the fire); (2) destructibility and value level (ie, property damage); and (3) hazards to human life (ie, personal damage). The question of which type of fire protection system is most expedient is discussed, whether automatic extinguishing system or fire alarm system, as a function of the time required for intervention. (Fachdok 13/0459)

2063. Berns C and Podany VO
SMOKE DETECTOR
US Patent No. 3,980,997; Cl 340/237 S, (G08B 17/10), Appl 17 Jul 1974, Discl. 14 Sep 1976, Assignec: General Signal Corp, Stamford, CT

A smoke detection apparatus including a pair of photoelectric cells that receive illumination selectively from a very low level light source is disclosed. One of the cells is termed the "direct" cell because it is in the direct path or on the axis of a narrow conical beam of light emanating from the source, the other cell being termed the "reflected" cell because it receives a significant part of its light input upon reflection of light from smoke particles or the like as such particles are drawn into the path of the light beam. Under predetermined smoke conditions, ie, when there is smoke obscuration of the light of 2% per ft (.01 optical density), an alarm signal is triggered. The very low level light source is a light-emitting diode that sensitively monitors the smoke obscuration; only a slight change in the illumination to the pair of photocells, connected in a sensing circuit, is required to produce the triggering signal. Accordingly, the smoke detection apparatus is highly sensitive to the presence of either so-called "white" smoke or "black," ie, non-reflective smoke, and either or both will trigger the alarm signal. 14 claims, 5 drawing figs. (Author)

FIRE TECHNOLOGY ABSTRACTS

5. FIRE PROTECTION PRINCIPLES

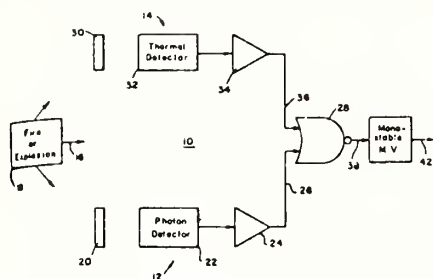
b. Detection and Alarm Equipment—Continued

2064. Cinzori RJ

DUAL SPECTRUM INFRARED FIRE DETECTOR

US Patent No. 3,931,521; CI 250/339, (G01J 1/00), Appl 29 Jun 1973, Discl. 6 Jan 1976, Assignee: Hughes Aircraft Co, Culver City, CA

Disclosed is a fire and explosion detection system wherein long-wavelength radiant-energy responsive signals are processed in one channel and compared to short-wavelength radiant-energy responsive signals that are processed in a second channel. When these signals are coincident in response to a fire or explosion of a predetermined threshold magnitude, an output fire suppression signal is generated. 19 claims, 4 drawing figs. (Author)



2065. Conforti FJ and Mensing CE

WARNING DEVICE

US Patent No. 3,932,850; CI 340/237, (G08B 17/10), Appl 22 Jan 1975, Discl. 13 Jan 1976, Assignee: Pittway Corp, Northbrook, IL

An improved warning device having means for sensing or detecting a predetermined danger or phenomenon has a compensation circuit for the sensing means, including compensating means connected to the sensing means, amplifier means connected to the junction of the sensing and compensating means, and a feedback circuit connected to the output of the amplifier means and the input of the compensating means for maintaining the output voltage of the amplifier means substantially constant despite slowly occurring changes in the voltage drop across the sensing means. Means, such as a resistance-capacitance network, is provided in the feedback circuit for rendering the amplifier means nonresponsive to slowly occurring changes in the voltage drop across the sensing means and for maintaining the amplifier means responsive to rapidly occurring changes in the voltage drop across the sensing means, as occurs in the presence of the danger or phenomenon to be detected. 14 claims, 1 drawing fig. (Author)

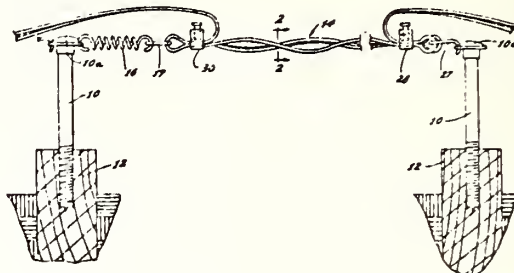
2066. Davies JS

ELECTRICALLY ENERGIZED FIRE AND/OR INTRUSION DETECTION SYSTEM INCLUDING SPRING-BIASED SWITCHING MEANS

US Patent No. 3,950,746; CI 340/420, (G08B 13/12), Appl 17 Sep 1970, Discl. 13 Apr 1976

An electrically energized fire and/or intrusion detection system is provided that includes an elongated electrically energized heat-sensing element, and which also includes a plurality of spring-biased switching devices mechanically

coupled to the heat-sensing element to respond to tension variations therein to provide predetermined control effects, such as initiating alarms and/or activating appropriate fire suppression devices. 6 claims, 9 drawing figs. (Author)

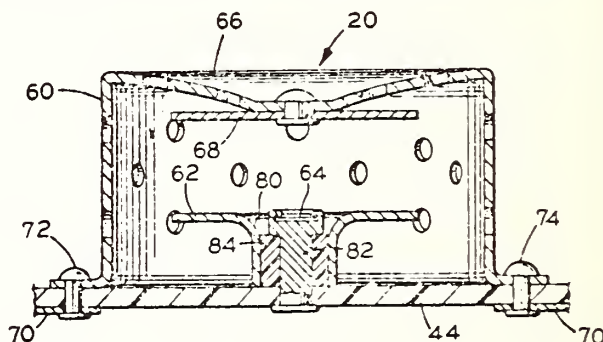


2067. Dobrzanski J and Hart EV

IONIZATION SMOKE DETECTOR AND ALARM SYSTEM

US Patent No. 3,934,145; CI 250/381, (G01T 1/18), Appl 25 Oct 1973, Discl. 20 Jan 1976, Assignee: Emhart Corp, Farmington, CT

An ionization smoke detector particularly suited to residential use is disclosed. The detector is battery-operated and is connected with a non-latching, pulsating alarm circuit. The detector has a sensing chamber formed by a perforated metallic shell and an electrode within which an insulated radiation source is centrally positioned to generate an ionization current for detecting smoke or other similar aerosols. The alarm circuit provides a pulsating alarm signal when smoke levels above a predetermined value are sensed. The alarm circuit also includes a low-voltage detection circuit for sounding the alarm when the end of useful battery life is approaching. 13 claims, 7 drawing figs. (Author)



2068. Greenspan M and Friedman A

SELF-SUSTAINING ALARM TRANSMITTER DEVICE

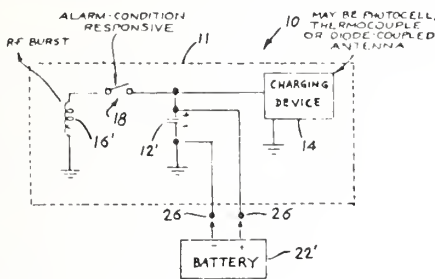
US Patent No. 3,980,996; CI 340/224, (G08B 21/00), Appl 12 Sep 1973, Discl. 14 Sep 1976

An alarm transmitter device includes a storage element that stores electrical charge and that energizes an output transmitting circuit upon the occurrence of an alarm condi-

5. FIRE PROTECTION PRINCIPLES

b. Detection and Alarm Equipment—Continued

tion. To maintain the storage element at full charge or in ready standby mode, a trickle charging circuit is provided that includes an energy conversion device for converting solar energy, broadcast electromagnetic energy, heat energy or the like into an electrical current suitable for trickle charging the storage element. After the storage element is substantially discharged, subsequent to an occurrence of an alarm condition, a battery or other source of electrical energy is connectable to terminals connected to the storage element for initially rapidly recharging the storage element to the fully charged state. 9 claims, 2 drawing figs. (Author)



2069. Griggs EA

TEMPERATURE CHANGE SENSING DEVICE

US Patent No. 3,952,692; Cl 116/102, (G08B 7/02), Appl 30 Jul 1975, Discl. 27 Apr 1976

This invention relates to sensing devices to be used in the manufacture of fire alarms and the like. The temperature-change-sensing device is adapted to be used in conjunction with an audible or visual warning device, comprising a temperature-sensitive means for rotating a first disc, having disposed about its surface at least one of a first cooperative coupling means. These first cooperative coupling means coincide with a second cooperative coupling means located on a second disc. When the ambient temperature reaches the preset temperature of the sensing device, the temperature-sensitive means rotates the first disc such that the first cooperative coupling means aligns with the second cooperative coupling means on the second disc. The second disc is then thrust toward the first disc by a biasing means, which has attached to it a means for tripping a visual or audible warning device. 10 claims, 4 drawing figs. (Author)

2070. Malinowski WJ

LIGHT DETECTOR WITH PULSED LIGHT SOURCE AND SYNCHRONOUS DATA GATING

US Patent No. 3,946,241; Cl 250/574, (G01N 21/26), Appl 14 Apr 1975, Discl. 23 Mar 1976, Assignee: Pyrotec, Inc, Hingham, MA

There is disclosed a detector of the type utilizing photo-electric detection of reflected light, which is almost completely immune to false alarms from changing ambient light and random electrical noise, with a sensitivity that is independent of ambient light, with a power consumption low enough to permit battery operation for a period of over 12 months. The light source is a light-emitting diode

that is pulsed at a low repetition rate, such as one pulse every two seconds, by an extremely short pulse, such as 20 microseconds. Voltage pulses generated when the reflected pulsed light is received by the photo-generative cell are amplified and applied to a level detector, the output of which is applied to the "set" terminal of a flip-flop circuit. The amplifier is on continuously; however, the level detector is pulsed to the "on" condition simultaneously with the on pulse to the light-emitting diode, and for the same period of time. Simultaneously with the application of the pulse to the light-emitting diode and the level detector, a shorter pulse is applied to a bi-stable switching device such as to the "re-set" terminal of the flip-flop circuit. The output of the flip-flop circuit may be applied through an integrator to an alarm-energizing switch. The integrator has a time constant that is longer than the pulse time, so that more than a single pulse from the flip-flop must be applied thereto to activate the alarm-energizing switch. The photo-voltaic cell is capacitor-coupled to the amplifier, so that constant or changing light, having a rate of change below that to which the amplifier responds, cannot affect the amplifier to cause a false alarm. Since the level detector is on only about 1/100,000 of the total time, a false alarm can be caused only by an extremely fast change in ambient light or a random noise pulse that occurs at the exact instant the level detector is on, in two consecutive pulse times. 8 claims, 4 drawing figs. (Author)

2071. McMillian LS and Frohwein GE

RATE-OF-CHANGE COMBUSTION AND CONTAMINATION DETECTION DEVICE

US Patent No. 3,946,374; Cl 340/237, (G08B 17/10), Appl 13 Dec 1973, Discl. 23 Mar 1976, Assignee: SCI Sys, Inc, Huntsville, AL

Described is an ionization-type gas contamination detector, intended primarily for use as a fire detector, in which a substance emitting predominantly low-energy beta particles is used as an ionizing radiation source in an ionizing chamber. Rapid changes in ionization current, which indicate the presence of a fire or smoke preceding a fire, are detected and an alarm is energized by a rate-of-change circuit in response to such changes. The output of the ionization chamber is amplified, and a level detector energizes the alarm when the amplified chamber output reaches a predetermined level. The output of the amplifier is adjusted relatively slowly to a reference level. In one embodiment, the amplifier output is adjusted to the reference level by the activation of a sample-and-hold feedback loop for a short period of time. In another embodiment, continuous feedback through a circuit with a relatively long time constant provides the desired adjustment. This feature makes the device relatively insensitive to normal atmospheric and environmental changes, while being very sensitive to changes in the level of combustion products in the atmosphere. 11 claims, 10 drawing figs. (Author)

2072. Newington TJ and Swanepoel LP

FIRE DETECTOR

US Patent No. 3,980,928; Cl 317/10, (H02H 3/16), Appl 22 Jul 1974, Discl. 14 Sep 1976, Priority: South Africa, 23 Jul 1973, 73/4995

5. FIRE PROTECTION PRINCIPLES

b. Detection and Alarm Equipment—Continued

The fire detector is of the type including a smoke chamber and a grid supported in the chamber on an insulating element. In order to prevent the flow of leakage currents from the grid to the body of the chamber, an electrically conductive element is arranged around the insulating element in circumferential contact therewith. The electrically conductive element is arranged to be at the same potential as the grid, so that no leakage currents are able to flow from the grid to the body of the chamber. 1 claim, 1 drawing fig. (Author)

2073. Nishino S

EMERGENCY ALARM AND EVACUATION SYSTEM

US Patent No. 3,969,720; Cl 340/371, (G08B 7/00), Appl 18 Jul 1975, Discl. 13 Jul 1976, Priority: Japan, Patent No 49-86322, 26 Jul 1974

An emergency alarm and evacuation system for directing persons to an emergency exit is disclosed. The system includes an alarm, a plurality of indicator units arranged in a line toward the emergency exit, and an operating unit coupled to the alarm and being operable in response to an output signal from the alarm to successively energize the indicator units in the direction of the exit. The indicator units each have a light and a buzzer so as to generate both an audible and visual indication at a common point, whereby persons may be guided by the sounds, the visual indications, or both, depending upon the smoke or noise conditions. 9 claims, 6 drawing figs. (Author)

2074. Vasquez T

ALARM SYSTEM

US Patent No. 3,980,995; Cl 340/213 R, (G08B 19/00), Appl 17 Dec 1974, Discl. 14 Sep 1976

Herein disclosed is a closed circuit alarm system comprising a number of alarm detectors, which system comprises an amplifier coupled through condensers to a first alarm relay and which is further coupled to a second relay, the arrangement being such that when an electrical signal is generated in the first relay, in response to the bridging of any of the alarm detectors, such electrical signal is amplified and applied to such second relay, thereby producing by said second relay an electrical signal that is applied to the first relay, which then operates for putting the alarm device in the circuit. The circuit alarm detectors, series-connected with the first alarm relay, are supplemented with electrical resistance elements in such a manner that when the electrical inlet of any of the alarm detectors is bridge-connected, an electrical resistance element associated therewith is also bridge-connected, thereby originating an electrical signal that will be amplified to operate the alarm device of the alarm circuit. 3 claims, 1 drawing fig. (Author)

2075. Dubetskiy VI

DEVICE FOR DETECTION AND EMERGENCY DISSECTION OF A SYSTEM WHEN A CERTAIN TEMPERATURE IS EXCEEDED

USSR Patent No. 494,755; Cl G08B 19/00, Appl 10 Apr 1974, Discl. 16 Mar 1976

The potential device contains a heat-sensitive component, a transistor with a resistor in the collector circuit. When the transistor temperature increases, its collector current increases and the voltage in the collector

decreases, bringing about a change in the original status of the circuit containing a pulse-amplitude converter. Current pulses from the output of the converter enter the collector circuit of the system. The device also contains a time-delay assembly to reduce the probability of actuation of the system cutoff circuit upon short-term fluctuations in temperature. The device is designed for the protection of various premises from hazardous overheating and fire. 2 drawing figs. (RZh)

2076. Jamison WB and Hadi H

IGNITION SUPPRESSION DEVICE. Consolidation Coal Co, Lee Eng Div, McMurray, PA; Bu Mines OFR-129-76, 251 pages, Aug 1976

Availability: NRIS PB-261 292/7GA

An ignition detection and suppression system was developed under the scope of this contract. The objective of this machine-mounted system was to detect flames caused by frictional sparking from the cutting bits of a continuous-mining machine and to suppress it with sufficient speed to prevent the development of an explosion, and to keep the flame from harming the machine operator.

2077. Cowie G

TEST PERFORMANCE OF AUTOMATIC FIRE ALARM EQUIPMENT. Fire Res Sta, Borehamwood, UK; Fire Res Note 1063, 8 pages, 1 table, 4 refs, Jan 1977

The results of type approval tests carried out on fire detection equipment are outlined, and the defects found in the equipment are discussed. Many pieces of equipment failed to meet the requirements of the tests. Similar failures or deficiencies were found to occur in several different types of equipment.

2078. Anon

MINE SHAFT FIRE AND SMOKE PROTECTION SYSTEM. VOL 1. DESIGN AND DEMONSTRATION (FINAL REPORT). FMC Corp, Advanced Products Div; Bu Mines OFR-24-77, 407 pages, Jul 1975

Availability: NTIS PB-263 577/9GA

After defining the metal mine shaft fire and smoke hazard problem, prototype hardware was designed and demonstrated through actual fire tests in a shaft/shaft station mockup, then at the 3,000 level of an operating mine shaft. The mine shaft fire and smoke protection system automatically warns of fire using both thermal and smoke fire detectors, then closes smoke doors and turns on sprinklers through remote controls at the surface and at the shaft station. (Author)

c. FIRE AND EXPLOSION RISKS

2079. Rines J

RURAL OUTBUILDINGS CAN BE DEATH TRAPS

Fire Command; 44(4):26-28, 1977

Barns and similar buildings can contain numerous hazards that are unlikely to be found in any other occupancy. These buildings rarely comply with even the most rudimentary safety codes. Some of the dangers are illustrated in this photo essay. 10 photos.

2080. Munck J

PREVENTION OF FIRES IN COMPRESSORS

Maschinenschaden; 49(4):159-161, 1976 (German)

5. FIRE PROTECTION PRINCIPLES

c. Fire and Explosion Risks—Continued

Light is shed in this article on the background of the regulations and German industrial standards UVV-VBG 16, DIN 51352 and DIN 51506 governing the design and operation of compressors, the composition and classification of lubricating oils. Users are given tips on how the hazards of fires, explosions and detonations in compressors can be largely eliminated. The author points out that the purchase of lubricating oils for a compressor is not simply a question of price for the purchasing division, but a question which is not subject to modification until an exact technical investigation is made. 6 refs. (Fachdok 13/0365)

2081. Singleton DW

BLAST CLEANING IN INFLAMMABLE ATMOSPHERES
Oil Colour Chem Assoc J; 59(10):363-368, 1976 (French and German Summaries)

Sparks are generated during the grit blasting of rusted steel. First investigated is whether these sparks are capable of igniting flammable liquids or gases of the type that might be present on the deck of a laden tanker. The results indicate that while the sparks produced are numerous, they are dull, and on no occasion have they ignited flammable gas mixture. A brief literature review indicates that other workers have reported similar findings. Following this work, a full-scale grit blasting trial was carried out at sea on a lubricating-oil tanker. Details of this work and the safety procedures followed are given. It is concluded that grit blasting can be used successfully on board vessels while they are at sea, provided all normal safety precautions, and some additional ones given in this paper, are taken. 9 figs, 2 tables, 2 refs. (Author)

2082. Shebeko V

FIRE HAZARD OF FOUNDRIES
Pozhar delo; (12):14, 1976 (Russian)

A fire occurred in the Zentrolit Foundry (USSR) in 1974 because of a defect in the ventilation system. The subsequent investigation of the automatic production system and of the production process uncovered several fire hazards and appropriate protective measures were initiated. The most important protective measures are: cleaning the ventilation ducts; adding fire-retarding agents to the binder and kerosine; and providing for vents in the roof of the production hall. (Fachdok 13/0706)

2083. Anon

PROBLEMS OF FIRE PROTECTION OF AIR-SUPPORTED STRUCTURES
Prom Stroit; (8):25-28, 1976 (Russian)

On the basis of fire tests of air-supported structures conducted in a number of countries, including the USSR, an examination is made of the features of their fire behavior and of fire protection methods. There is some question as to overestimating the fire-resistance criteria of such structures in view of their specific features of overpressure beneath a shell and low mass. 4 figs, 1 table, 6 refs. (RZh)

d. FIRE LOADS

2084. Voirol A

THE VIEWPOINT OF SWISS FIRE PREVENTION SPECIALISTS

Ann Inst Tech Batim Trav Publics; 29(341):66-67, 1976 (French)

A mathematical method of evaluating the fire hazard of various premises based on a fire hazard factor, which is determined as a function of several fire hazard indexes (combustibility, building dimensions, smoke-generating capability, etc), is proposed. A study of the fire hazard of urban buildings in terms of total fire load has shown that there are no more than 20 different types of residential, commercial and administrative buildings and 18 types of industrial buildings. Depending on the type of building, it is possible to determine the fire category to which it belongs. Catalogs of the various indexes were established, making it possible to calculate the fire hazard factor for each category. Special catalogs were developed for storage and warehouse areas, where values are given for a cubic meter of space.

2085. Smith EE

TRANSIT VEHICLE MATERIAL SPECIFICATION USING RELEASE RATE TESTS FOR FLAMMABILITY AND SMOKE. PHASE I REPORT. Ohio State Univ, Dept Chem Res, Columbus, OH; IH-5-76-1, 36 pages, Oct 1976
Availability: NTIS PB-262 895/6GA

The report relates to two of the most important features in fire safety design of a transit vehicle's interior finishes and furnishings: to allow time for evacuation, and prevent a self-propagating fire. Comparative evaluation of fire performance of a fire system (as contrasted with the evaluation of the individual materials in the system) are discussed in terms of a model in which the interdependence of materials and the system are mathematically simulated to give an absolute (as compared to comparative) evaluation of a fire system and to predict what limits on loading will prevent fully developed fires in a specific situation. (Author)

e. HEAT AND PRESSURE LOAD EFFECTS ON STRUCTURES

2086. Anon

POST-TENSIONING MANUAL

Post-Tensioning Inst, Glenview, IL; 2nd•edit, 300 pages, 1976

The manual is intended to increase understanding and effective use of the structural, economic, and esthetic advantages afforded by post-tensioning. Coverage of applications of post-tensioning hardware or systems, post-tensioning materials and grouting specifications, and design, detailing, and construction procedures have been updated from the first edition to reflect current practices. Fire resistance of post-tensioned structures, with summaries of data from 18 standard fire tests, is also included in the manual. A new chapter on prestressed rock and soil anchors has been added in response to the significant growth in this application over the past five years. An appendix and section on design aids provide moment coefficients for continuous structures, aids for calculation of

5. FIRE PROTECTION PRINCIPLES

e. Heat and Pressure Load Effects on Structures—Continued

friction losses and anchor setting losses, and materials parameters.

2087. Ellingwood B and Shaver JR

RELIABILITY OF RC BEAMS SUBJECTED TO FIRE

ASCE Proc. J Struct Div; 108(ST5):1047-1059, 1977

Methods for analytically predicting the behavior of reinforced concrete beams subjected to fire are presented. These incorporate the temperature-dependent strength degradation in the steel, as well as thermal and creep strains. The parameters that are important for predicting beam behavior are identified through a sensitivity study. The application of reliability analysis techniques in developing fire-resistant design procedure is also examined. Using probabilistic methods, safety factors for design can be developed which are commensurate with the required reliability and levels of uncertainty arising from basic randomness and modeling error. 10 figs, 1 table, 18 refs. (Author)

2088. Harmathy TZ

FIRE RESISTANCE VERSUS FLAME SPREAD RESISTANCE

Fire Technol; 12(4):290-302, 330, 1976

The term "fire resistance" as applied to compartment boundaries is actually a measure of their ability to prevent the spread of fire by mechanisms implied by the standard test procedure. However, fires spread by different mechanisms. Compartment boundaries may be exposed to fire on both sides, in which case the results of the standard fire test do not apply. From an analysis of the performance of a common structural element under realistic fire conditions, it was concluded that the conventional concrete-steel structures are likely to function satisfactorily in a spreading fire, providing the control parameter of the fire is higher than the critical value. 6 figs, 2 tables, 7 refs. (NFPA)

2089. Paleev DY and Feklov AI

HEAT DISTRIBUTION IN A FOAMED PLASTIC BULKHEAD EXPOSED TO UNDERGROUND FIRE CONDITIONS

Izv Vyssh Uchebn Zaved. Gorn Zh; (9):62-67, 1976 (Russian)

A mathematical model of heat distribution in a foamed plastic bulkhead is given with allowance for endothermic decomposition reactions (pyrolysis) of the organic part of the foam material. The differential thermal-conductivity equation, together with initial and secondary conditions, makes it possible to get the temperature distribution at any instant in the part of the bulkhead with the greatest heat load under various conditions of heat addition to the surface of the bulkhead. At the same time it is possible to follow the process of thermal decomposition of the foam material and to use the data to estimate the time over which the bulkhead will retain its insulating properties. 3 figs, 7 refs. (RZh)

2090. Tamura S and Motoyama T

STUDY OF THE CONDITION OF BRIDGE TRUSSES AFTER A FIRE

Tetsudo Doboku; 18(5):334-338, 1976 (Japanese)

The causes, circumstances and nature of the development of the highway bridge fire that occurred in July 1975 on the high-speed Fukuda (Japan) freeway are reported. The cause of the fire was a collision between a bulk-oil trailer truck and an oncoming tracked load-construction vehicle. The results of an inspection of the bridge structure carried out several days after the fire to determine whether and what repairs would be necessary to restore the bridge, which was made of unitized reinforced concrete components, are presented. The results of the inspection, which are given in graphic and table form, contain data on the spatial deformations and excess static loads resulting from linear and spatial expansions of the structural components of the bridge from the high temperatures. 6 figs, 4 tables. (RZh)

1. PREVENTION AND HAZARD REDUCTION

2091. Colombies fnu

THE POSITION OF FIREMEN IN PREVENTION

Ann Inst Tech Batim Trav Publics; 29(341):53-55, 1976 (French)

A member of the Paris Fire Department discusses the principles of fire protection of buildings as they apply to firemen. On the basis of a fire scenario, it is determined that the safety of building occupants depends on a certain number of "delays," namely, alarm, evacuation, response, and attack. For the fireman, the effective period during which firefighting is possible without danger of building collapse depends on the response time and the effectiveness of preventive measures, especially the fire rating of the structure, the latter being the more important. 1 fig.

2092. DeCicco PR

WHAT TO DO WITH EXISTING ROW-FRAME RESIDENTIAL BUILDINGS

Fire J; 70(6):23-29, 69, 1976

Ignorance of fire hazards among the tenants in crowded low-income neighborhoods is equalled by the indifference or inability of the landlords to eliminate the hazards. Test fires in row frame dwellings in Brooklyn, NY, demonstrated the importance of separating individual buildings and avoiding vertical penetrations, such as shafts and horizontal communications, as found in the common cockloft and other concealed spaces. Significant protection was offered by aluminum siding against both external and internal fires. Early warning detection and alarm devices are recommended, as well as "mini" sprinkler devices connected to the building water supply. 11 figs, 6 refs. (NFPA)

2093. Kawaller SI

EXPOSED PLASTIC FOAM INSULATION REQUIRES THERMAL BARRIER PROTECTION

Fire J; 70(6):66-69, 1976

Current code philosophy requires the installation of an effective thermal barrier over all exposed plastic foam installations that would prevent a heat rise on the surface of the foam to 250°F and could provide this protection for at least 15 minutes. The use of plastic foams is limited to those having a flame spread rating between zero and 75, according to the standard tunnel test. Among accepta-

FIRE TECHNOLOGY ABSTRACTS

5. FIRE PROTECTION PRINCIPLES

f. Prevention and Hazard Reduction—Continued

ble barriers are 1/2 in. of portland cement plaster, reinforced with wire mesh, and magnesium oxychloride formulations. Magnesium oxychloride offers protection equivalent to portland cement plasters with the addition of only 0.8 pound of weight per square foot. (This article is a revised version of an address presented by the author at the symposium on "Plastics in Building Construction" at a meeting of the American Chemical Society held recently in New York City.) (NFPA)

2094. Vervalin CH

LOSS PREVENTION IN THE HPI (HYDROCARBON PROCESSING INDUSTRY)

Hydrocarbon Process; 55(7):205-206, 208, 211, 214, 216, 1976

In a five-part series of articles, the author, a member of the *Hydrocarbon Processing* staff, abstracts a number of papers presented at the Loss Prevention Symposium held in Kansas City, MO, on April 10-14, 1976, under the sponsorship of the American Institute of Chemical Engineers. The first part of the series is devoted to the paper of TA Kletz of Imperial Chemical Industries, entitled "Some Accidents that Will Take Place in the Coming Year," in which an attempt is made to predict some loss-causing situations which will occur in hydrocarbon processing plants this year on the basis of a study of loss-incident case histories. The typical accident causes are identified as tank collapse, breaking into or welding a branch on the wrong pipeline, tank slopover, water-hammer damage to pipes, trip failure and disconnection of a pressurized flex. A detailed case history of a fire in a light hydrocarbon plant of the Dow Chemical Company's Louisiana Division helps to illustrate how incidents might have been prevented. (For the remaining parts of the series, see the Source Index, *Hydrocarbon Process*, Vol 55, Nos 8, 9, 10, and 11.) 3 refs.

2095. Vervalin CH

LOSS PREVENTION IN THE HPI (HYDROCARBON PROCESSING INDUSTRY)

Hydrocarbon Process; 55(8):182-184, 1976

In this second part of a five-part article devoted to abstracts of selected papers presented at the 1976 Loss Prevention Symposium, the author abstracts the paper of WW Russell of the Monsanto Chemical Company entitled "Hazard Control of Plant Process Changes." The hazards resulting from plant process changes are illustrated in detail with the example of the disposal of a flammable gas effluent from a vacuum jet system that must be modified to comply with changes in pollution control regulations. Hazards resulting from changes effected to reduce production costs are also cited. The relationships leading to such problems are defined, as are some remedial and preventive actions. (For the other papers in the series consult the Source Index, *Hydrocarbon Process*, Vol 55, Nos 7, 9, 10 and 11.) 1 ref.

2096. Vervalin CH

LOSS PREVENTION IN THE HPI (HYDROCARBON PROCESSING INDUSTRY)

Hydrocarbon Process; 55(9):321-322, 324, 327-328, 331-332, 335, 337, 1976

Three papers are abstracted in this third part of a five-part article devoted to papers presented at the 1976 Loss Prevention Symposium to illustrate accidents caused by process changes and plant modifications in the hydrocarbon processing industry, plus some remedial methods. The three papers cited in this part are: G Booth, "Accidents Caused by Process Changes," dealing with three accident case histories relating to heating of nitro compounds, nitrations, and sulfonation of nitro compounds; TA Kletz, "Must Plant Modifications Lead to Accidents?," devoted to case histories of accidents resulting from modifications to both process and equipment; and PM Herron, "Accidents Caused by Plant Modifications," in which remedial steps in control of plant-modification incidents are reported. (For the other papers in this series consult the Source Index, *Hydrocarbon Process*, Vol 55, Nos 7, 8, 10 and 11.) 1 table.

2097. Vervalin CH

LOSS PREVENTION IN THE HPI (HYDROCARBON PROCESSING INDUSTRY)

Hydrocarbon Process; 55(10):215-216, 218, 220, 222, 1976

Remedial technology and procedures are considered in the fourth part of this five-part series devoted to papers from the 1976 Loss Prevention Symposium. The three papers abstracted in this part are as follows: JW Watts, "Effects of Water Spray on Unconfined Flammable Gas," in which the effects of water curtain tests on the detonation properties of unconfined ethylene-air and hydrogen-air mixtures were measured and the yields of deflagrations and detonations were determined; GC Vincent *et al*, "Hydrocarbon Mist Explosion Prevention by Water Fog," in which the mist formed by hot vapors of high-boiling-point hydrocarbon leaking into cool air and, if sufficiently concentrated, capable of deflagrating, is examined; and GC Vincent *et al*, "Hydrocarbon Mist Explosion Prevention by Explosion Suppression," in which the possibility of explosion of heat transfer fluids (in this case Dowtherm A) and suppression of the explosion using Halon 1301 are examined. (For the other papers in the series consult the Source Index, *Hydrocarbon Process*, Vol 55, Nos 7, 8, 9, and 11.) 3 refs.

2098. Vervalin CH

LOSS PREVENTION IN THE HPI (HYDROCARBON PROCESSING INDUSTRY)

Hydrocarbon Process; 55(11):305-306, 1976

The final part of the five-part series of articles devoted to selected papers of the 1976 Loss Prevention Symposium deals with safe furnace design and operation. Abstracts of the paper of KE Coulter and FC Tuttle on "Modern Concepts of Safe Furnace Design and Operation" are presented. Guidelines established by Dow Chemical from experience gained in the proper design and operation of furnaces in the hydrocarbon processing industry are discussed. (For the other articles in the series consult the Source Index, *Hydrocarbon Process*, Vol 55, Nos 7, 8, 9, and 10.) 1 ref.

2099. Murakami M, Sekijawa A and Hormuti S

EXPLOSIONS AND FIRES CONNECTED WITH THE USE OF LOW-PRESSURE MAINS GAS IN RESIDENTIAL BUILDINGS

Kasai; 26(1):24-31, 1976 (Japanese)

5. FIRE PROTECTION PRINCIPLES

f. Prevention and Hazard Reduction—Continued

It is stated that the use of low-pressure mains gas in residential buildings complies with the natural potentials and economic interests of Japan, in view of the constant increase in demand for such gas. At the same time, however, a mean annual increase in the number of explosions and fires connected with the use of low-pressure gas is observed. Statistical data classifying such accidents by the various causes are cited. An analysis is made of the main problems to be solved if an appreciable increase in the safety of domestic use of this gas is to be reached. It is noted in particular that 20% of domestic gas ranges are not yet equipped with reliable modern automatic safety and control devices. Also reported is the development of a new type of gas range with built-in burners provided with complex automatic safety and control devices. 5 figs, 21 tables, 2 refs. (RZh)

2100. Niwa K

METHODS TO PREVENT THE LEAKAGE OF GAS AND OIL*Puranto Enjinia*; 8(7):45-48, 1976 (Japanese)

The technical devices and organizational and engineering measures to prevent the leakage of gas and fire-hazardous vapors of the oil-refinery products presently used and being introduced in the Japanese petrochemical industry are described. Some of the varieties of safety equipment for pressurized containers, in particular two types of safety valves, spring-actuated and lever, are described, as is the use of such valves in plants of the Sekiyu-Tsutome complex, where two valves, a working (main) valve and a control valve, are used together in many production machines. The control safety valve advances the product into the closed system. The valves are adjusted in such a way that the control valve is actuated first; if it does not reduce pressure to the working level, the working valve is actuated. It is pointed out that this system of safety valves reduces product losses considerably and curtails emissions into the atmosphere. (RZh)

g. PROTECTIVE DEVICES AND EQUIPMENT

2101. Dubovik VI (Ed)

SMOKE PROTECTION OF MULTI-STORY BUILDINGS

[Protivodymovaya Zashchita Mnogoetazhnykh Zdanii]

VNI Protivopozhar Oborony, Moscow, USSR; 72 pages, 1976 (Russian)

This digest of papers contains 9 articles on the process of heat exchange in the corridor of a fire floor, the optical properties of smoke, and the smoke-generating capability of construction materials. The experimental setup, a portion of a highrise building for the study of smoke charging, is described. Diagrams of the smoke protection of highrise office buildings are given. The digest is intended for fire equipment and fire safety engineers, designers and architects working in the field of public and residential building construction. The nine papers are: Testing Smoke Protection, Including Stairwell Pressurization and Smoke Removal from a Corridor; Fire Protection of Highrise Office Buildings; Model of Floor-to-Floor Heat and Gas Transfer During Fires; Experimental Study of Heat and Gas Transfer on the Fire Floor of a Residential Building; Experimental Study of the Smoke Protection of a Highrise Administrative Building; Formula for Calculating the

Hydraulic Drag of Stairwells; Study of the Parameters of Smoke Protection Ventilation Systems on a Model; Standardization of the Smoke-Generating Capability of Building Materials; and Apparatus for Experimental Measurement of the Optical Density of Smoke in an Enclosure. (Author)

2102. Morgan HP and Bullen ML

A METHOD OF EXTRACTING SMOKE FROM BUILDINGS USING A WATER-AIR JET PUMP*Fire Technol*; 12(4):311-320, 1976

Smoke extraction from fires in large structures, such as covered shopping complexes, is important for safe evacuation. The water-air jet pump can be an effective method of removing smoke and hot gases from fire situations, especially where the gas temperature prevents a fan from being used without special protection. A quantitative theory was developed and tested experimentally which predicts reasonably well the performance of a water-air jet pump having a high air-water volume ratio. High throughput ratio jet pumps have been proposed for firedamp extraction from coal mines. A similar system is available for removing hot, smoky gases from basement fires. 7 figs, 7 refs. (NFPA)

2103. Wakamatsu T and Tanaka T

SMOKE CONTROL DESIGNING IN BUILDINGS. PART 4*Kasai*; 26(1):37-39, 1976 (Japanese)

Given are the basic analytical computations and formulas for the construction of optimal computer algorithms used in calculating the fundamental technical parameters of smoke-removal ventilation systems in buildings. A table of substitution parameters is given to form the required algorithm; these parameters take into account the geometrical features of the occupancies for which the smoke-removal systems are being calculated. Also examined are three examples of constructing computational algorithms for specific premises with fixed geometrical dimensions and configurations. The proposed method of constructing computational algorithms also takes into account the natural aerodynamic features of the premises for which the calculation is being made, in particular the intensity and distribution of convective air flows. 4 figs, 1 table. (RZh)

2104. Quenzel K-H

FIRE LOAD AND COMBUSTION VELOCITY AS THE BASIS FOR THE DESIGN OF SMOKE AND HEAT REMOVAL SYSTEMS*Klima Kaelteing*; 4(10):361-366, 1976 (German; English and French Summaries)

Smoke and heat removal systems are becoming increasingly an essential component of a building or of ventilating systems. A distinction is made between exhaust openings provided by the builder in the construction stage and those provided by special mechanical equipment. In the case of mechanical heat and smoke removal vents it is particularly necessary to determine the energy released by any eventual fire and the increase in temperature of the air being removed. Only then is it possible to specify materials and equipment. An effort is made in this article to set up computational data for typical rooms, in order to obtain a basis for the design of smoke and heat removal systems. 6 figs, 4 tables, 7 refs. (Author)

5. FIRE PROTECTION PRINCIPLES

g. Protective Devices and Equipment—Continued

2105. Anon

AUTOMATIC DOOR OPENER FOR EMERGENCY FIRE EXITS*Kuki tyowa to reito*; 16(7):152-154, 1976 (Japanese)

A description is given of the design, operating principle, and technical parameters of an electromechanical device designed for operation in conjunction with a fire detector as one component of a complex fire-safety system. The fire detector operates in an ambient temperature range of -10 to $+50^{\circ}\text{C}$ from a d-c network (24V, 2A). In case of fire, the detector initiates a high-amplitude (0.3A) d-c control signal, which actuates a relay. Closure of the relay contacts supplies power (+24V) to the winding of an electromagnetic solenoid, resulting in longitudinal displacement of the solenoid core, which is electromechanically connected to the follower lever of the door. The electrical circuitry of the system is devised for series connection of an unlimited number of analogous devices, so that in case of fire the doors of emergency exits equipped with these devices automatically swing open. The follower lever develops a force of 20-25 kg (for 0.2 sec). The overall dimensions of the device (together with the fire detector unit) are 200 x 144 x 62 mm; the weight is 500 g. The sequence of operations for installation and regulation of the device is described. 3 figs, 1 table. (RZh)

2106. Westhoff W

FIRE PROTECTION CLOSURES*Mitt Inst Bautech*; 7(6):161-176, 1976 (German)

The use of fire-protection closures has increased appreciably in the last few years since the regulation agencies have become aware of their importance in fire compartmentation. Several requirements must be imposed on doors and gates of varying design in order to guarantee their performance as fire closures. These requirements have been formulated in the standards and building-authority licenses, which are the subject of this article. The guidelines for licensing fire-protection closures are reproduced in the regulative portion of the article (second version, the September 1976 draft). Also given is a compilation of the building-authority licenses for fire-protection closures that are of quality-certified (controlled) fabrication. 7 refs (Fachdok 13/0319)

2107. Anon

CHOOSING PROPER FIRE PROTECTION SYSTEMS*Mod Plant Oper Maint*; 16(4):27-31, 1976

The production program and custom services of Walter Kidde and Company, the major manufacturer and installer of fire detection and fire protection systems, are presented. 5 photos.

2108. Hayashi T, Shibata M, Yamaguchi H, Sakurai H and Kanehara K

RESEARCH ON AN AIR SHUTTER FOR FIRE PROTECTION. PART 1*Nihon Kasai Gakkai Ronbunshu*; 25(1/2):1-15, 1975 (Japanese; English Summary)

The results of analytical studies to determine the theoretical potential and optimal structure of all possible systems of forced air-flow control, particularly ventilation and convective flows, in buildings of complex configuration are presented. The design, operating principle, and

technical potentials of several versions of such systems being used in Japan and other countries, based, as a rule, on automatic damping of air flows in case of fire, are examined. Computational formulas establishing optimal relations between such control system parameters as configuration and volume of the premises being serviced, capacity and throughput of the air-handling system, the speed and intensity of natural convective air flows, etc., are given. A detailed aerodynamic analysis is made of forced and convective flows for several variants of typical premises and buildings. On the basis of the analysis recommendations are made in optimizing the design and basic technical parameters of air-flow control systems operating as a composite part of the fire-detection system of these premises and buildings. The computational results are presented in graph form. 20 figs, 23 refs. (RZh)

2109. Ammosov F, Dubovik VI, Karpov L and Stetsovskiy M

FIRE TESTS OF STAIRWELLS*Pozhar delo*; (12):23-24, 1976 (Russian)

The Fire Protection Division of the Yakutsk ASSR and the All-Union Fire Protection Research Institute of the USSR conducted a program of full-scale fire tests in a four-story residential building to study smoke propagation paths, the temperature conditions in a burning enclosure and stairwell, and also the possibilities of evacuating people under conditions of uninhibited fire development and of stairwell pressurization. The temperatures in the first-floor fire room and the stairwell were measured with windows, doors and roof vents open and closed, in various combinations, and with stairwell pressurization by smoke-removal fans. Test conditions and results are reported in detail. The stairwell pressurization method of smoke removal was judged to be ineffective. It is recommended that natural ventilation ducts for smoke removal from the upper portion of the stairwell with 1.2 m^2 automatically opening louvers and ventilation louvers automatically actuated by smoke detectors in the basement be installed to protect this type of building. 2 figs.

2110. Edwards A

FIRE PROTECTION OF BUILDINGS*Prot Civ Secur Ind*; (253):16-17, 1976 (French)

Some of the types of fire-protection equipment produced by British industry are described, such as small fire alarm systems for hotels, stores and factory buildings, a miniature fire siren working on 6, 12, 24 or 200/250V, and a 113,500 liter water container made of a composite material using glass fiber. 2 figs.

2111. Fukuda T, Kousaka H and Mitsuda T

EMERGENCY POWER SUPPLY EQUIPMENT FOR FIREFIGHTING*Toshiba Rebyu*; 31(6):535-539, 1976 (Japanese; English Summary)

The technical parameters of mass-produced Japanese electrical batteries, gas-fueled generators, storage cells and other types of emergency power sources to supply fire systems and individual types of fire-fighting equipment with power are given. The principal technical specifications for the electrical equipment of fire- and explosion-hazard premises are also formulated. It is pointed out

5. FIRE PROTECTION PRINCIPLES

g. Protective Devices and Equipment—Continued

that according to the Japanese standards for local and temporary illumination in such premises only battery-powered lamps without explosion hazards can be used. The parameters and a description of lamps produced by the Toshiba Electric Company are presented. Also described are several types of fire safety control panel systems equipped with explosion-proof lever switches, automatic blocking units and other automatically controlled components. 9 figs, 4 tables. (RZh)

2112. Carpenter RE

FIRE-RETARDANT PANEL CONSTRUCTION

US Patent No. 3,967,033; Cl 428/307, (B32B 3/26), Appl 22 Dec 1975, Discl. 29 Jun 1976, Assignee: Ashland Oil Inc, Ashland, KY

A fire-resistant structural panel is provided in form of a sandwich assembly having outer metallic skin surfaces and a core section composed of a thermal barrier layer adjoining at least one side of a layer of a foamed polymeric insulating material, said thermal barrier being a thermoset resinous composition containing homogeneously dispersed colloidal-size droplets of water. 6 claims, no drawings. (Author)

2113. Dean JO

DOOR SECURITY PIN

US Patent No. 3,937,506; Cl 292/300, (E05C 19/18), Appl 19 Sep 1974, Discl. 10 Feb 1976

A security pin for installation between a door jamb and a door to prevent unauthorized entry through the door, when locked, by removal of the door hinge pins. The invention serves to permit expeditious egress from a building in the event of a fire. 6 claims, 7 drawing figs. (Author)

2114. Dry H

DAMPERS

US Patent No. 3,951,051; Cl 98/42R, (F24F 7/06), Appl 2 Jul 1974, Discl. 20 Apr 1976, Assignee: Wallace-Murray Corp, New York, NY

Dampers operable by energization of an electrical circuit or by deenergization thereof to open or close, for control of smoke ventilation in case of a fire. The dampers are held closed, or open, either by a magnet or by a spring. The dampers may be used in ventilation systems of any other type. 18 claims, 7 drawing figs. (Author)

2115. Harwood FS and Dorst HO

WARP RESISTANT FIRE DOOR

US Patent No. 3,981,102; Cl 49/501, (E06B 3/16), Appl 22 Jun 1974, Discl. 21 Sep 1976, Assignee: Dover Corp, New York, NY

A warp-resistant fire door structure is disclosed, which includes a frame and a pair of front and back panels mounted thereon. The panels are secured permanently to the frame only at points adjacent their lateral edges. At other points, the panels are heat-releasably bonded to the frame to be able to expand and contract relative to the frame in the presence of ambient temperature extremes. 6 claims, 3 drawing figs. (Author)

2116. Jecmen JM and Jecmen J

ASTRAGAL

US Patent No. 3,943,663; Cl 49/370, (E06B 7/16), Appl 6 Dec 1974, Discl. 16 Mar 1976, Assignee: Harris Preble Co, Cicero, IL

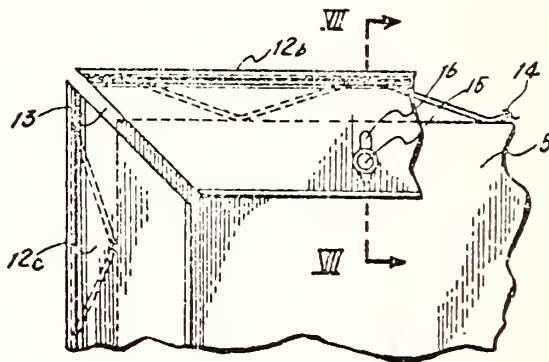
The present invention relates to safety astragals designed for use on horizontally divided, vertically moving freight elevator doors to prevent fire. The improved astragal is formed by joining two layers of flexible fire-resistant material to form an envelope, which is then shaped, extensions of said envelope overlapping to form a joint contiguous to a mounting bar used to affix the astragal to the elevator door. 12 claims, 4 drawing figs. (Author)

2117. Nakai T, Shimonomura I, Nakayama I and Yoshii Y

FIRE SMOKE DAMPER

US Patent No. 3,980,272; Cl 251/306, (F16K 1/228), Appl 15 Jan 1975, Discl. 14 Sep 1976, Priority: Japan, 7 June 1974, Appl. No. 49/65386, Assignee: Nittan Co, Ltd, Japan

A fire and smoke damper is disclosed for installation in a duct that includes a plate rotatably mounted within the duct and having means enclosing the periphery of the plate and biased outwardly to engage the duct wall when the damper is in the closed position. 3 claims, 12 drawing figs. (Author)



2118. Rohrer JF

FLAME RETARDING FILTER DEVICE

US Patent No. 3,955,949; Cl 55/444, (B01D 45/08), Appl 15 Oct 1974, Discl. 11 May 1976, Assignee: Smith Filter Corp, Moline, IL

A flame-retarding filter device is disclosed for use in an air exhaust system wherein the exhaust air carries grease particles and the like susceptible to combustion. The device has first and second rows of spaced parallel baffle elements, each of which has a generally planar central portion and inclined longitudinal edges. The rows of baffle elements are supported in spaced relation with the baffle elements of the rearward row overlying the spaces between the baffle elements of the front row in a manner to retard the passage of flames through the device while allowing sufficient free flow of air through the unit to exhaust heat and odors from the room in which the device is employed. 8 claims, 5 drawing figs. (Author)

5. FIRE PROTECTION PRINCIPLES

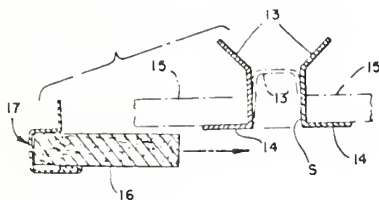
g. Protective Devices and Equipment—Continued

2119. Stephenson FJ and Rush DJ

FIRE RESISTANT CEILING CONSTRUCTION

US Patent No. 3,969,864; CI 52/475, (E04B 5/57), Appl 4 Oct 1974, Discl. 20 Jul 1976, Assignee: Butler Manufact Co, Kansas City, MO

Disclosed is a fire-resistant ceiling for a building having a space grid construction comprised of a plurality of horizontally extending space trusses with bottom chords or bases thereof having oppositely directed flanges supporting fire-resistant ceiling panels thereon, and grid-protecting fire-resistant panels secured to the space truss bottom chords between adjacent edges of the ceiling panels to protect the space trusses from fire. 8 claims, 10 drawing figs. (Author)

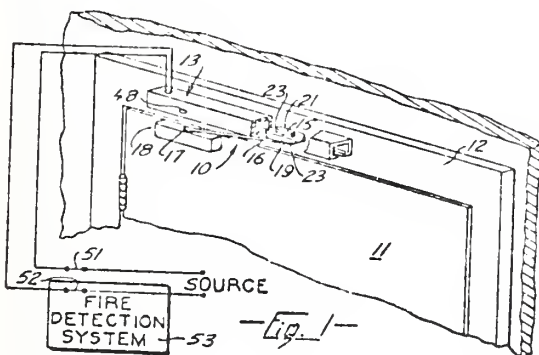


2120. Tansley HW

ELECTROMAGNETIC DOOR HOLDING DEVICE

US Patent No. 3,964,125; CI 16/48.5, (E05F 15/20), Appl 12 Jun 1975, Discl. 22 Jun 1976

An electromagnetic door holding device is disclosed for a door closer of the type having a spring-operated rotating spindle operatively connected by an arm to a slider mounted for reciprocal movement in a track usually secured to the door frame wherein the slider has a cam which, when the door is swung to a fully opened position, engages and is held by an electromagnet against movement relative to the slider when the door attempts to return to a closed position and which engages and moves a detent carried by the slider into engagement with detent engaging means in the track so as to prevent movement of the slider relative to the track and thus releaseably hold the door in the open position. The energizing of the electromagnet allows the spring to move the cam out of engagement with the detent and thus permit the slider to move and enable the door to move to a closed position. 6 claims, 5 drawing figs. (Author)



2121. Toyoshima S, Honda M, Nakamura K and Seki K

SYSTEM FOR OPERATING FIRE PREVENTION DEVICES

US Patent No. 3,979,648; CI 317/139, (H01H 47/14), Appl 10 Mar 1975, Discl. 7 Sep 1976, Assignee: Nohmi Bosai Kogyo Co, Ltd, Tokyo, Japan

The system for operating fire-prevention devices such as fire shutters or smoke exhaust vents comprises a plurality of fire prevention device operators successively operated directly or through another already operated operator in response to the operation of one of the fire detectors. Each of the operators includes switch means for switching the circuit from one operator to another when the fire prevention device associated therewith completes its operation. The switch means also function to switch the circuit upon the failure of the fire prevention device within a predetermined time. 2 claims, 4 drawing figs. (Author)

h. SUPPRESSION DEVICES AND EQUIPMENT

2122. Wegemann H

A CRITIQUE OF HALON EXTINGUISHERS

Brandschutz; 30(12):324-325, 1976 (German)

Highly optimistic and, in part, incorrect data in reports and advertising brochures on a Halon extinguisher, as well as a general downgrading of an extinguishant that has proven its worth for decades, namely, dry powder, induced the author to make a critical assessment of the Halon 1211 extinguishant. Only in certain specific cases and only for certain objects is the extinguishing effectiveness of Halon indisputable. At the same time, however, the harmful effects of this agent on humans when exposed to Halon over a period of time and the highly corrosive effect of the pyrolysis products of Halon cannot be overlooked. Halon extinguishers should be used only by trained people. For these reasons, the concept of "universal extinguishant" does not hold for Halon. (Fachdok 13/0373)

2123. Nash P

THE ESSENTIALS OF DRY POWDER AND GASEOUS EXTINGUISHING SYSTEMS

Fire Prev; (118):21-24, 1977

This third in a series of three articles describing the mechanics and uses of the various types of fire-extinguishing systems deals with some special protection extinguishing systems, which may be grouped according to the extinguishing agent they employ as dry-powder, inerting gas (carbon dioxide), and inhibiting gas (halons) systems. The tactical and technical features of these systems are described, along with their toxicity and applications. The two preceding articles, the first on water, the second on foam extinguishing systems, were reviewed in *FTA*, 1(5), abstracts 1702 and 1703. 3 figs, 3 tables.

2124. Anon

THE PERFORMANCE OF AUTOMATIC SPRINKLER SYSTEMS

Fire Prot Rev; 40(436):17, 19-20, 1977

Discussed in this article are primarily the advantages of automatic sprinkler systems compared to other fire

5. FIRE PROTECTION PRINCIPLES

h. Suppression Devices and Equipment—Continued

extinguishing methods. The topics under discussion are: the trade-off of fire resistance of a building against sprinklers; sprinkler failures and statistics; water damage; test procedures devised to ensure reliability; sprinkler sensitivity to heat radiation; and response times.

2125. Ivchenko AI, Korol AA, Shibanov VS and Chernikov AB
METHOD OF CALCULATING THE PARAMETERS OF POWDER FIRE EXTINGUISHERS
Gornospasat delo; (13):14-16, 1976 (Russian)

At the All-Union Mine-Rescue Research Institute (USSR) a method has been developed to calculate the parameters of fire extinguishers operating on the principle of expelling powder by compressed gas. A theoretical calculation of the main parameters of an OP-8u powder fire extinguisher, such as weight of the powder charge, volume of the container and driving pressure in the container, the weight of the gas expellant, and the cross section of the spray nozzle, was made by this method. It can be recommended to calculate the parameters of hand and portable powder fire extinguishers in which powder with a mean particle size of no more than 100 microns is used. (RZh)

2126. Kozlyuk AI, Charkov VP, Shetser GM, Vasilenko VV, Vishnevskiy LD and Zasevskiy VV
THE HIGH-PERFORMANCE V'YUGA FOAM GENERATOR
Gornospasat delo; (13):9-13, 1976 (Russian)

In order to extinguish fires in vertical and enclosed shafts, as well as in workings of an area near a shaft from the surface, the mobile, high-performance V'yuga foam generator has been developed at the All-Union Mine-Rescue Research Institute (USSR). A diagram and technical characteristics of the device are given. A calculation is made of the main geometrical dimensions of the annular air distributor, making it possible to reduce the length of the diffuser appreciably. The results of a test of the foam generator are presented. 1 fig. (RZh)

2127. Polovinko ID, Sergienko VI, Lapin KI and Bezukh VF
FIRE PROTECTION OF INCLINED MINE WORKINGS EQUIPPED WITH CONVEYOR BELTS
Gornospasat delo; (13):6-8, 1976 (Russian)

The results of laboratory and industry tests show that the "Tuman" (fog) system is highly effective in mines. One of the important advantages of the system is its high sensitivity to temperature increases, which actuates the system in the initial stage of fire development. (RZh)

2128. Nakakuki A, Nagayama K and Motoe T
SPRINKLER FIRE EXTINGUISHING SYSTEMS
Kasai; 26(1):40-45, 1976 (Japanese)

It has been found that automatic fire extinguishing systems equipped with sprinkler heads are the most effective of all the fixed systems. The technical parameters of these systems, illustrating the developmental history for the period 1925-1969, in particular the purpose, power, output (the flow of fire extinguishing solution per unit time), the diameter of the sprinkler heads, etc., are presented. The principal operating characteristics of these

systems are given. The main trends in the future development of the design of sprinkler heads and systems using them are analyzed. It is noted that the most advanced sprinkler heads are those designed to automatically vary the angles of inclination of the spray as a function of the size and configuration of the seat of the fire. These sprinkler heads are rather costly to manufacture and service, but are highly effective in extinguishing fires. 3 figs, 4 tables (RZh)

2129. Nakakuki A, Motoe T and Nagayama K
SPRINKLER FIRE EXTINGUISHING SYSTEMS
Kasai; 26(2):122-126, 1976 (Japanese)

The design and operating principle of several of the basic versions of sprinkler fire extinguishing systems are considered. Fixed sprinkler systems are classified. The design of each type of sprinkler head presently in use is examined in terms of its hydrodynamic features. The design and operating principle of the test stand used to determine the efficiency of some specific types of sprinkler heads in various fire-extinguishing systems are described. A more detailed analysis is made of the design and features of sprinkler heads that can vary the configuration of the jet of fire-extinguishing agent as a function of the nature and size of the incipient fire or as a function of the shape and size of the premises being protected. 16 figs. (RZh)

2130. Yamada A
FIRE EQUIPMENT OF THE ENAYAMA AND AMIKAKE TUNNELS
Kasai; 26(2):85-91, 1976 (Japanese)

The design, configuration and operating principle of fixed automatic fire extinguishing systems installed in the Enayama and Amikake vehicular tunnels (8,489 and 1,943 m long, resp) in Japan are described. These tunnels are strategically important links of a 4-lane superhighway with a traffic load of 1,000 to 1,855 vehicles per hour. Fires in the tunnels are detected by means of fire detectors uniformly distributed over the inner surface of the tunnels. In the case of fire the supervisory distributor system switches on an electric motor that drives a pump or set of pumps, depending on the size of the fire. Water is supplied from a fixed 40m³ reservoir through a network of sprinkler heads. In addition to the automated systems, the tunnels are also equipped with observation stations tended by operators. 21 figs, 2 tables, 3 refs. (RZh)

2131. Starokozhev II and Semenov VP
EXTINGUISHING COTTON WOOL
Khlopk Prom; (2):23-24, 1976 (Russian)

The problem of extinguishing cotton in bales is considered. The quantitative index for the extinguishing efficiency is the specific expenditure of the fire-extinguishing agent required to extinguish a fire in a certain period of time. The extinguishing efficiency was studied on models of cotton bales for the operation of a varying number of drenchers. Water and water with wetting agents were used as the extinguishants. It is demonstrated that water with wetting agents is highly effective for extinguishing purposes. 2 figs, 1 table, 3 refs. (RZh)

5. FIRE PROTECTION PRINCIPLES

h. Suppression Devices and Equipment—Continued

2132. Tato H

FIRE-EXTINGUISHING AND SMOKE-REMOVAL SYSTEMS*Kuki tyowa to reito*; 16(5):108-120, 1976 (Japanese)

The tactical features and specifications and a description of the design and operating principle of several of the most recent modifications of complex fire equipment designed and produced by the Nittan Company (Tokyo) are presented. The NSS-50 system, which is designed for the automatic detection and selective extinguishment of fires in large buildings, is described in detail. The system includes a distributed network of various types of fire detectors, from which information is transmitted to the control station, which is equipped with an electronic commutator. When a fire breaks out, the commutator issues an instruction to the actuator unit, which causes the electric pumps to start automatically and the extinguishing solution to run into those sections of the pipes with sprinkler heads located in the pertinent areas of the building where the fire is to be extinguished. The control station is also equipped for automatic telephone communication with the municipal fire department. Also described is a fixed forced ventilation and smoke-removal system produced by the Nittan Company in 14 different versions. Such a wide production inventory of smoke-removal systems is required because of the wide range of use. The installed electric power of the systems varies from 1.5 to 18.5 kW; the throughput is from 120 to 1,000 m³ of air (smoke) per minute, the rarefaction being 20-40 mm Hg. 17 figs, 14 tables. (RZh)

2133. Anon

A FIRE-FIGHTING SYSTEM USING HALON 1301 GAS*Motor Ship*; 57(671):92-93, 1976

The Saval-Kronenburg Halon 1301 total flooding system for ship machinery spaces is described. The system is of the central bulk storage type. Either one or two storage vessels are used. The pressure vessels are installed, together with actuating equipment, in a compartment separate from the spaces to be protected. The gas is discharged into a pipe system provided with discharge nozzles installed in the protected spaces as required such that a homogeneous distribution is achieved. Release of the gas is designed to be primarily from a pneumatic control station positioned near the entrance of the protected spaces and secondarily from a mechanically operated station in the Halon storage room. System layout and operation and the monitoring and protection equipment are described. (See also the article in *Safety Sea Internat* (89):10-12, 1976, abstracted in this issue of *FTA*.) 1 fig.

2134. Eriksson L

FUTURE TRENDS OF FIRE PROTECTION FOR TANKERS*New Ships/Neubauten*; 21(7/8):169-170, 1976

Discussed in brief are the future trends of fire-extinguishing systems for tankers, including AFFF foam concentrates, foam monitors, foam playpipes, fire-resistant borosilicate glass for portholes, and dry chemical powders.

2135. Bubir I, Brushlinskiy N and Voloshanenko A

MATHEMATICAL DETERMINATION OF THE TIME REQUIRED TO EXTINGUISH FIRES WITH SPRINKLER SYSTEMS*Pozhar delo*; (11):24-25, 1976 (Russian)

At the Advanced Fire Engineering Academy (USSR) an analysis was made of 884 fire incidents from the years 1974-1975 in which sprinkler systems were activated. The results of the analyses are compiled in three tables and five mathematical formulas. In 52% of all fire incidents the fire was extinguished by sprinkler systems in 11.84 ± 1.1 min. The formulas make it possible to determine the level of the fire-damage risk. The formulas can be used to design sprinkler systems and to assess the insurance risk. 3 tables. (Fachdok 13/0649)

2136. But P, Vasil'ev A, Petrov I and Mishin V

DESIGN OF AUTOMATIC FIRE EXTINGUISHING SYSTEMS*Pozhar delo*; (10):24-26, 1976

Guidelines of temporary recommendations for the design of automatic fire extinguishing systems for oil and oil-product storage areas are cited. Air foam with an expansion factor of 70-100 obtained from a GVP foam generator is recommended as the principal extinguishing agent. Specifications for the foam flow rate, water requirements, and foam concentrate are regulated by the Construction Standards and Regulations. The response time of the extinguishing systems is 3 min; the extinguishing system can be actuated by an initiating pneumatic system with sprinkler heads or DPS-038 and TRV-32 detectors. The requirements for the system equipment are described. 1 fig. (RZh)

2137. Krasnoperov V

INCREASING THE OPERATIONAL RELIABILITY OF AUTOMATIC FIRE EXTINGUISHING SYSTEMS*Pozhar delo*; (10):27, 1976 (Russian)

The problem of the reliability of automatic fire extinguishing systems is considered. A "utilization factor" is proposed for use in evaluating the working capacity of such systems. This factor represents the ratio of the time of trouble-free operation during the period being considered to the total time of operation and lost time, for which an expression is given. It is shown that one of the reasons for gas fire-extinguishing system failures is that the automatic gas discharge heads malfunction at the instant they are actuated. (RZh)

2138. Krishtal'skiy B

MECHANICAL FOAM TOWER*Pozhar delo*; (11):24-25, 1976 (Russian)

A brief comment is made by the author on an improvement in the field of fire technology. Four or eight foam generators, two monitors, and a hydraulically driven telescoping tower were mounted on a tracked prime mover (ATL-5). The foam can be applied onto tanks 17 m in height by means of the telescope towers. Burning containers can be cooled off by the monitors. The prime mover is equipped with a blade and can be used as a bulldozer, so that the fire site can be approached even under difficult conditions. 2 figs. (Fachdok 13/0602)

5. FIRE PROTECTION PRINCIPLES

h. Suppression Devices and Equipment—Continued

2139. Sviridov B, Nuzer L and Yushnikov G
AUTOMATIC FOAM DELIVERY SYSTEM
Pozhar delo; (12):26-27, 1976 (Russian)

A description is given of an automatic air-foam fire-extinguishing system for the painting section in a large plant in the USSR. The system (a block diagram is given) consists of three foam-solution containers, a distributor rack, fire detectors, foam drenchers installed in the painting rooms, explosion-proof electromagnetic valves, piping and control gear. The control circuit is described in detail using a block diagram. The operation of the system is outlined. 2 figs.

2140. Gudmundson G
DRY CHEMICAL FIRE EXTINGUISHING ABOARD TANKERS
Safety Sea Internat; (89):33-34, 1976

In an era that points to increasing sizes of tonnage-units for transport of highly flammable products combined with intensified freighting activities, the ship's own fire protection naturally becomes extremely important. The authorities concerned are vitally occupied with increasing the fire security on board and constant research and product development is carried out in order to render both means and methods more efficient. It is now necessary to have access to equipment for fighting not only large, but also severe fires. The special dry chemical systems for tank deck protection on LPG, LNG, chemical and combined crude chemical tankers are described and illustrated. (Author)

2141. Pucill PM
FIXED FIRE EXTINGUISHING INSTALLATIONS FOR GENERAL CARGO SHIPS
Safety Sea Internat; (89):14, 17-18, 1976

A feature of the fire risk in ships is the wide variety of types of fire that can occur. The disparity extends also to the likely delay in discovery, the growth rate, the threat that it offers (ie, to life, to the cargo, or to the vessel), and to the fixed installations for dealing with them. If there is any extinguishing installation in accommodation areas, it is almost certainly sprinklers. These are well understood, documented and controlled. They are, therefore, not considered further in this article except to note that in the early stages of fire in accommodation spaces the most immediate threat is to the life of persons who may be sleeping there, for which purpose a sprinkler system is not ideal. Cargo-holds and machinery spaces are considered primarily in this article. Combined detection and CO₂ extinguishing systems, inert-gas generating systems, water spray, high-expansion extinguishing systems, inert-gas generating systems, water spray, high-expansion foams, halons, and the future are discussed. 1 fig, 1 table. (Author)

2142. Anon
A TOTAL FLOODING FIRE EXTINGUISHING SYSTEM
Safety Sea Internat; (89):10-12, 1976

Statistics indicate that every year the largest number of fires on board ships occur in machinery compartments. These fires, particularly those arising from oil spillages, lubricating and fuel line failures, tend to turn quickly into major fires, and for that reason an effective fire-extin-

guishing system must be installed. The Netherlands company Saval-Kronenburg BV has developed and delivered a new Halon 1301 total flooding system for marine applications which, as claimed, means a new approach in firefighting on board ships. The system is described in this article, in particular the operations of the system, which are reviewed step by step, along with an accompanying diagram and chart of the system. (See also the article in *Motor Ship*, 57(671):92-93, 1976, abstracted in this issue of FTA.) 1 fig. (Author)

2143. Anon
CHOOSING THE RIGHT FIRE EXTINGUISHER
SBZ; 31(8):556, 1976 (German)

More than 50% of all fire extinguishers are manufactured, stored and checked in accordance with official specifications. Choosing the right extinguisher is difficult for the non-specialist because of the confusing number of different types, differing in design, size and performance. All these factors are reflected in the cost of extinguishers, and therefore it is often the cheapest, not the best one, that is chosen. The most widely used extinguisher is the chemical powder type, which has compressed air or carbon dioxide as the expelling agent. Extinguishers that are filled with the expelling agent and extinguishing compound in one container are not reliable because the extinguishant can escape through leaks in the shut-off mechanism or because of imperfect welding seams in the housing. The preferred extinguisher is one in which the expelling agent and extinguishant are stored separately with the expelling agent in a special high-pressure cylinder, from which it is discharged into the main container immediately before the extinguishant is applied to a fire. For this reason the latter extinguisher is highly reliable.

2144. Anon
CHOOSING THE RIGHT FIRE EXTINGUISHER
Tankstelle; 23(5):254, 1976 (German)

Considering the large variety of types and designs of fire extinguishers, the people who are responsible for procuring them are usually not specialists, and therefore only the purchase price is often the guiding factor in choosing extinguishers. It is pointed out that local fire inspection offices (in Germany) have special information services to aid the uninitiated in choosing the correct fire extinguisher for specific purposes.

2145. Kalinin NV, Bodrov AI, Matyukkin KA and Solov'ev VA
FIREFIGHTING APPARATUS USING A JET ENGINE
Torf Prom; (9):26-27, 1976 (Russian)

A fire apparatus to produce a water and gas jet to extinguish peat fires was built at the Syverdlovsk Peat Association (USSR). The apparatus consists of a VK-1A aircraft jet engine with an ejector-mixer mounted on the chassis of a URAL-375 truck. Water is supplied to the system at a rate of 230 m³/hr by a DDN-70 pump. (RZh)

2146. Igishev VG, Sukkanov GV and Kravtsov AG
EXPERIENCE GAINED USING WATER-AIR FOAM TO PREVENT AND EXTINGUISH ENDOGENOUS FIRES
Ugol; (8):59-62, 1976 (Russian)

5. FIRE PROTECTION PRINCIPLES

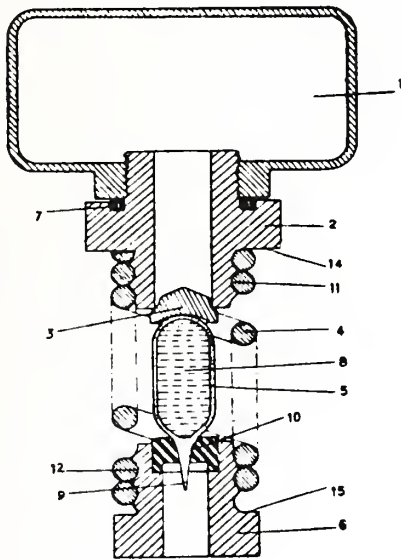
h. Suppression Devices and Equipment—Continued

A method of preventing and extinguishing endogenous fires in the worked-out portion of coal seams is described. (RZh)

2147. Rocheler E
AUTOMATIC ACTUATOR FOR A FIRE EXTINGUISHER

French Patent No. 2,273,562; Cl A62C 37/30, Appl 10 Jun 1974, Discl. 2 Jan 1976

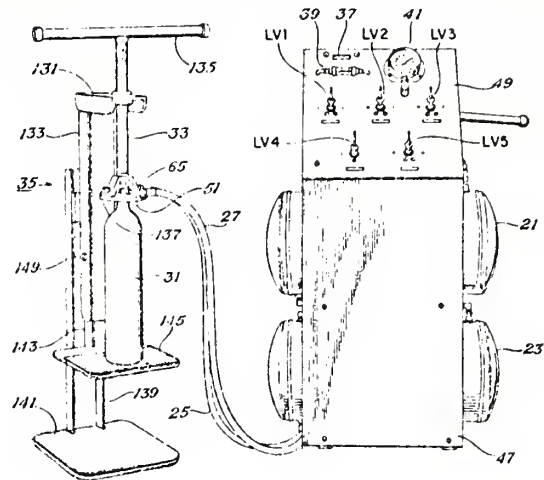
The invention relates to a device for automatic actuation of fixed fire extinguishing systems. The device consists of a valve that is kept in closed position by a glass ampule filled with liquid. When the temperature rises to a certain level, the ampule breaks, releasing the valve. The spring-driven valve is displaced, allowing discharge of the fire extinguishant. 1 drawing fig.



2148. Bower JC and Roach SV
HYDROSTATIC TESTER FOR FIRE EXTINGUISHER
US Patent No. 3,951,185; Cl 141/1 R, (B65B 55/18), Appl 28 May 1974, Discl. 20 Apr 1976, Assignee: Pyronauts, Inc, Fort Worth, TX

The specification discloses a closed system for cleaning, pressure testing, and drying fire extinguisher containers. The system comprises two tanks for holding trichloroethane and flow lines and a valve control system for flowing the liquid from one tank into the container to be cleaned, pressure-tested, and dried, and then from the container to the other tank. After a number of containers are cleaned and pressure-tested and the second tank becomes full, the valve control system can be controlled to reverse the flow of liquid from the second tank to the containers to be cleaned, pressure-tested, and dried and then back to the first tank. In a further embodiment, there is provided a universal head adapted to fit many different sizes of fire extinguisher container openings and, in addition, an adjustable holding device for holding the

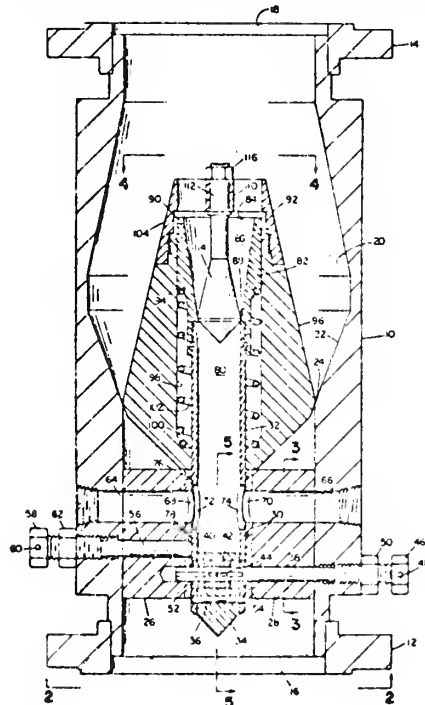
container to be tested between a support plate and the head and for inverting the container to allow the container to be emptied after the test is completed. 26 claims, 4 drawing figs. (Author)



2149. Sanderson IS and Hardy JC
PROPORTIONING APPARATUS

US Patent No. 3,934,604; Cl 137/98, (G05D 11/02), Appl 30 Aug 1974, Discl. 27 Jan 1976, Assignee: Rockwood Systems Corp, South Portland, ME

Disclosed is a proportioning apparatus comprising a pair of coaxial tubular members with passages having first and



5. FIRE PROTECTION PRINCIPLES

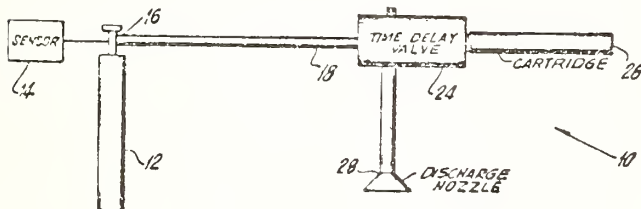
h. Suppression Devices and Equipment—Continued

second outwardly extending walls of the same cross-sectional configuration, first and second valve bodies for coaction with said walls for progressively opening and closing said passages, said first valve body slidably mounted on one of said tubular members, said second valve body connected to said first valve body for movement therewith and biasing means urging said valve bodies to their closed positions. 14 claims, 5 drawing figs. (Author)

2150. Christensen BC and Emmes RC
PNEUMATIC TIME DELAY VALVE

US Patent No. 3,990,516; CI 169/19, (A62C 37/06), Appl 8 Oct 1975, Discl. 9 Nov 1976, Assignee: The Ansul Co., Marinette, WI

A valve body contains a coaxially slidable valve element with a seal member at the upstream end and a pair of differential area pistons at the other end. Fluid passage means direct fluid from the upstream end to a zone between the pistons to cause the pistons to seat the seal member. An orifice in the downstream, larger-area piston bleeds fluid to an accumulator of preselected volume. Once the pressure forces on the large piston balance, the pressure force on the small piston unseats the seal member. 10 claims, 3 drawing figs. (Author)

2151. Ferguson WJ and Luich RJ
PRESSURE GAUGE CONSTRUCTION

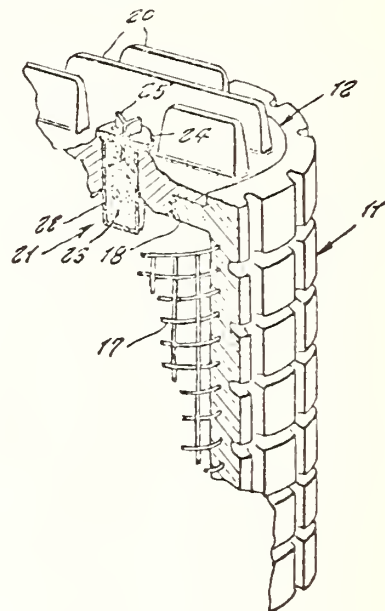
US Patent No. 3,952,598; CI 73/415, (G01L 7/04), Appl 28 Jul 1975, Discl. 27 Apr 1976, Assignee: Dresser Industries, Inc., Dallas, TX

A pressure gage of small size and type suitable for fire extinguisher use is disclosed. Comprising the gage is a dial plate secured in keyed registration onto the front face of the casing. A tubular stem extending laterally from the inside face of the viewing crystal is axially slotted to embrace a radial portion of a wound Bourdon tube supporting a pointer opposite the dial plate. Rotating the crystal before securing it to the casing enables the tube slot to zero position the pointer at the zero graduation on the dial plate. When secured to the casing the distal end of the crystal stem compresses an O-ring washer for effecting an internal pressure seal between the casing and Bourdon tube thereat. 10 claims, 8 drawing figs. (Author)

2152. Kirk N
FIRE EXTINGUISHING BOMB FOR PUTTING OUT FIRES

US Patent No. 3,980,139; CI 169/28, (A62C 19/00), Appl 15 Sep 1975, Discl. 14 Sep 1976

Disclosed is a bomb containing an explosive and a fire extinguishing chemical so that the bomb can be exploded within a fire and extinguish the flames, the bomb including a glass cylinder that can be readily fragmented so to disperse its chemical content into all directions and the glass cylinder having extending fins so to absorb a rising temperature such as from a vicinity fire, the fins transferring the heat to an explosive charge for automatic operation. 3 claims, 3 drawing figs. (Author)

2153. Tyler ME
QUICK-OPENING VALVE OPERATED BY EXPLOSIVE CHARGE

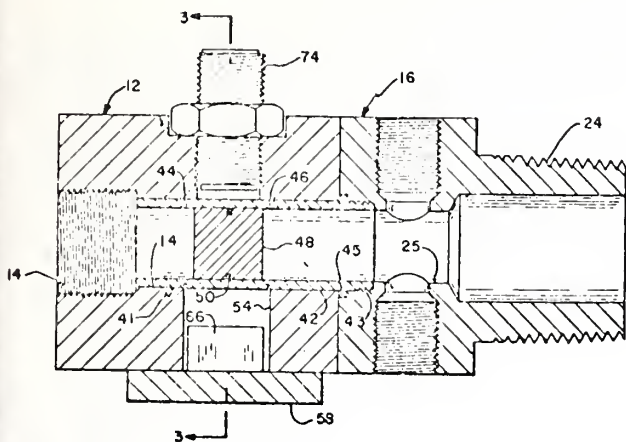
US Patent No. 4,003,395; CI 137/68 A, (F16K 13/06), Appl 28 Jul 1975, Discl. 18 Jan 1977, Assignee: Systron Donner Corp., Berkeley, CA

A quick-opening valve is disclosed for use in opening flow through a passageway from a source of pressurized fluid, such as a fire extinguisher fluid. The valve comprises a valve body in which a flow-blocking member is mounted to form a portion of the passageway. In one embodiment an imperforate plug is mounted within tubing to form the flow-blocking member, and a pair of weakened zones is formed by circular grooves in the tubing at opposite axial ends of the plug. In another embodiment the plug is formed integral with hollow cylindrical walls to form the flow-blocking member. A deflagrating charge is mounted in the valve body for generating explosive gas pressure so that the weakened zones are sheared. A slug that includes the plug is ejected in a direction

5. FIRE PROTECTION PRINCIPLES

h. Suppression Devices and Equipment—Continued

at right angles to the passageway and into a slug receiving chamber. The ejected slug is deflected by a ramp to absorb excess energy. A one-way spring detent prevents the slug from rebounding back into the passageway and obstructing fluid flow. 3 claims, 7 drawing figs. (Author)



2154. Linden G, Dierk L and Tiedtke K
PROCESS FOR THE AUTOMATIC REPORTING AND EXTINGUISHING OF FIRES

US Patent No. 4,005,754; Cl 169/46, (A62C 37/04), Appl 6 Mar 1975, Discl. 1 Feb 1977

A process for the automatic reporting and extinguishing of fires and an automatic fire reporting and extinguishing system capable of performing such process are provided. The process uses at least two different types of fire reporting devices and requires a signal from each type of device in order to respond by releasing extinguishing agent. This requirement eliminates many false alarms and unnecessary releasing of extinguishing agent. According to the process, extinguishing agent is released in a predetermined quantity and then a check is made to determine whether the fire has been extinguished. If the fire is not extinguished, another quantity of extinguishing agent, equal to the first, is released. Succeeding quantities of extinguishing agent are released until the fire is extinguished or the extinguishing agent is spent. 9 claims, 5 drawing figs. (Author)

2155. Specht GE
PRESSURE CONTROL VALVE

US Patent No. 3,946,756; Cl 137/495, (F16K 31/14), Appl 30 May 1974, Discl. 30 Mar 1976, Assignee: A-T-O Inc, Willoughby, OH

Disclosed is a pressure control valve for use in conjunction with a riser for supplying water, in case of a fire, at all levels of a multiple-story structure at a predetermined regulated static and flowing discharge pressure. The valve includes a hand wheel on a stem engaging the valve, a normally inaccessible static pressure control collar in said stem and a diaphragm sensitive to flowing discharge pressure at the discharge side of the valve tending to close the valve and a spring opposing the diaphragm, said hand wheel arranged to move said valve stem relative

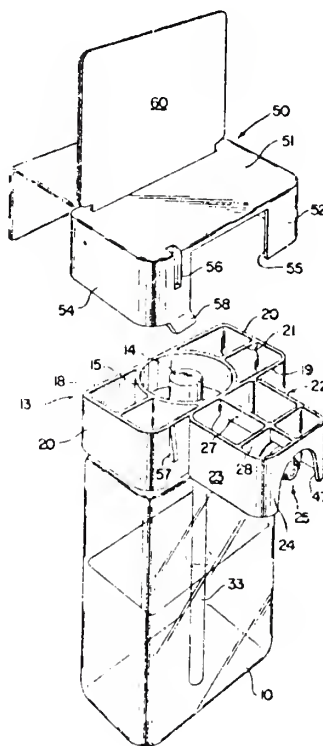
to said diaphragm and close the valve without altering the pressure adjustment thereof. 3 claims, 3 drawing figs. (Author)

2156. Tenney KS and Roby MA

FIRE EXTINGUISHER PACKAGE FOR WASTE RECEPTABLE

US Patent No. 4,013,127; Cl 169/57, (A62C 35/10), Appl 22 Jan 1975, Discl. 22 Mar 1977, Assignee: Rubbermaid Commercial Products, Inc, Winchester, VA

A fire extinguisher package or assembly adapted for attachment to the top rim of a waste receptable is disclosed. A small translucent plastic container holds pressurized extinguisher liquid, and a heat-activated valve for discharging and directing the liquid is connected to the top of the container and enclosed in a protecting shroud. The shroud or a cover therefor is mounted on the receptable rim by releasable attaching means. 10 claims, 10 drawing figs. (Author)



2157. Nash P

PORTABLE AND INSTALLED FIRE-FIGHTING EQUIPMENT IN BUILDINGS. Fire Res Sta (UK); BRE CP-3-77, 11 pages, 15 figs, 6 refs, Jan 1977

This note describes the range of portable and installed first-aid fire-fighting equipment in buildings for the use of the occupants in case of emergency. It gives a guide to the fire-fighting capability and most likely usage of each type of equipment. (Author)

5. FIRE PROTECTION PRINCIPLES

h. Suppression Devices and Equipment—Continued

2158. Nash P

SPRINKLER AND SPRAY SYSTEMS FOR MARITIME USE. Fire Res Sta (UK); BRE CP-1-77, 7 pages, 6 figs, 11 refs, Jan 1977

This paper gives an account of the international regulations and requirements governing the use of automatic sprinklers and water spray systems in ships and describes some typical marine installations. It also gives an account of the testing procedures for sprinklers and spray systems, pumps, and water supplies. Further detailed information may be obtained from the comprehensive list of references. (Author)

6. FIRE SAFETY

a. AGRICULTURE AND WILDLANDS

[For more complete coverage of the forest fire literature see Forest Fire Control Abstracts (Canada).]

2159. Matsui T, Umeda K and Nakada Y

METHOD OF FIRE PREVENTION IN FIELDS

US Patent No. 3,980,140; CI 169/45, (A62C 3/02), Appl 12 Mar 1974, Discl. 14 Sep 1976, Priority: Japan, Patent No 48-28067, 12 Mar 1973, Assignee: Kansai Nissan Chemicals Ltd, Osaka, Japan

An aqueous fire-preventing suspension is prepared by diluting a mixture of magnesium ammonium phosphate and an emulsion of a resin and a surfactant that can be sprayed onto weeds in fields in a concentration of greater than 30% magnesium ammonium phosphate per weight of dried weeds. 7 claims, 1 drawing fig. (Author)

b. COMMERCIAL OCCUPANCIES

2160. Izumi Y and Ozawa J

A FIRE-SECURITY SYSTEM FOR OFFICE BUILDINGS

Mitsubishi Denki Gihō; 50(7):394-400, 1976 (Japanese; English Summary)

A description is given of a block diagram and the operating principle of a new complex automatic fire-safety system, MELNICS, developed by the Mitsubishi Electric Company for use in multistory office buildings. The system control station is located in a special area and consists of a large number of devices connected to peripheral subsystems and to a central panel containing a small computer. The main subsystems comprising the MELNICS system are as follows: a network of different types of fire detectors distributed over all areas of the building; a fixed, automatically replenished water tank located in the foundation area of the building and also an array of pressurized cylinders containing the foam concentrate of the fire extinguishing solution; a mixer in which the fire-extinguishing solution is prepared (automatically); a network of pipes and sprinkler heads to extinguish the fire in the early stage of development; an emergency forced ventilation subsystem; a network of sensitive pickups that react to the presence of gas in an enclosure; an emergency elevator control subsystem; and a subsystem for remote automatic opening of doors of reserve and emergency exits by means of special electro-mechanical drive systems. Some of the results of systems tests are reported. 10 figs, 3 tables, 6 refs. (RZh)

c. ELECTRICAL

2161. Anon

FIRE PROTECTION IN PREMISES FOR ELECTRONIC DATA PROCESSING EQUIPMENT

Elektriker; 15(7/8):183-184, 1976 (German)

The major guidelines of a set of specifications for fire protection in electronic data processing areas worked out by the Property Insurers Association (Verband der Sachversicherer eV), in collaboration with the Federal German Industrial Association (Bundesverband der Deutschen Industrie eV) are reproduced in this article. The guidelines are intended primarily for conditions in large computer centers. Less extensive protective measures tailored to less hazardous conditions can be used for medium-sized and small facilities.

2162. Tada R

SELECTING FIRE-SAFE ELECTRICAL EQUIPMENT IN INDUSTRIAL ENTERPRISES

Puranto Enjinia; 8(7):52-56, 1976 (Japanese)

The method adopted in Japan to allow for ambient conditions when selecting explosion-proof and fire-safe electrical equipment of various kinds for large modern industries is analyzed. Described in particular is a method for determining the category and group of vapors and gases that form explosion- and fire-hazardous mixtures in premises. A table regulating the relationship between the autoignition temperature of the mixture and the index of the group to which a given gas- and vapor-air mixture belongs is given. Group G1 includes autoignition temperatures above 450°C; group G2, 300 to 450°C; G3, 200 to 300°C; G4, 135 to 200°C; and G5, 100 to 130°C. The new Japanese standard contains 5 fire-hazard categories for electrical equipment as a function of the fire-protection level: explosion-proof equipment with a housing capable of withstanding the pressure of an internal explosion; equipment with oil protection in which the spark-producing and current-conducting parts are immersed in diesel oil; highly reliable, explosion-proof equipment in which sparking and surface overheating are excluded; equipment with automatic ventilation systems that maintain a certain internal overpressure and thus prevent the intake of explosive mixtures into the housing; and explosion-proof equipment with a low spark-producing level. Also given are data used in selecting electrical equipment. 3 tables, 3 refs. (RZh)

2163. Westphal H

FIRE HAZARDS OF ELECTRICAL DEVICES IN THE HOME

Schadenprisma; 5(4):76-78, 1976 (German)

Reference is made to the damages that are attributable to faulty electrical installation, improper use of electrical home appliances, or faults in the devices. An analysis of causes reveals that fires can be started by ignoring the simplest rules designed to prevent them, by failing to pay attention to the correct cross section of the conducting wire when starting heavy, newly installed electrical devices, and by failing to check the operating safety of the system at certain time intervals. Improper use, operating errors, carelessness, and negligence frequently make a great risk out of electrical power. The manufac-

6. FIRE SAFETY

c. Electrical—Continued

turers of electrical devices are called on to adhere to the pertinent regulations of the Society of German Electrical Engineers (VDE), as well as the fire-protection guidelines of the Association of Property Insurers for the installation of electrical power systems in items of equipment. 9 figs. (Fachdok 13/0287)

2164. Guenther K

BBC IN THE SERVICE OF FIRE protection

Sicherheitsing; 7(7):10-12, 14-16, 1976 (German)

The Brown Boveri Company (FRG) is guided in its fire safety research area by the recommendations of its Equipment Fire Protection Committee. The members of the committee issue recommendations on fire safety aspects of the company's electrical equipment and promote preventive measures. Particular emphasis is placed on specialization of committee members in the various aspects of fire protection. 8 figs.

d. INDUSTRIAL OCCUPANCIES

2165. Tiezzi I

FIRE PROTECTION SYSTEMS. MODERN TRENDS FOR PETROLEUM AND PETROCHEMICAL PLANTS [I Sistemi di Difesa Antincendio. Moderni Orientamenti per Impianti Petroliere e Petrochimici]

Ed Prot Civ, Rome, Italy; 143 pages, 1976 (Italian)

The book is divided into four parts. The general aspects of the problem are outlined in part 1. Part 2 is devoted to an analysis of the existing standards for the design of petrochemical plants, taking into account the fire hazards of such installations. A detailed outline of modern fire protection systems, both fixed and mobile, is given in part 3, along with recommendations regarding the organization of fire extinguishment and accident suppression in manufacturing equipment. The outlook for the development of fire-fighting equipment for the protection of oil- and gas-processing machinery is discussed in part 4. The book contains tables and graphic illustrations.

2166. Linetskiy VA and Pryanikov VI

OCCUPATIONAL SAFETY, SAFETY ENGINEERING, AND FIRE PREVENTION IN PLANTS OF THE CHEMICAL INDUSTRY [Okhrana Truda, Tekhnika Bezopasnosti i Pozharnaya Profilaktika na Predpriyatiyakh Khimicheskoy Promyshlennosti]

Khimiya, Moscow, USSR; 438 pages, 1976, (Russian)

This book contains the theoretical principles and an analysis of the practical aspects of occupational safety, safety engineering, industrial health and hygiene in the chemical industry. The results of contemporary research on protection of the workforce and safety engineering, as well as on the practical advances made along these lines by leading plants in the chemical industry, are presented. 78 figs, 5 tables, 200 refs. (RZh)

2167. Anon

PREVENTION AND CONTROL OF FIRE IN THE PRINTING INDUSTRY

British Printing Industries Fed and the Fire Prot Assoc, UK; 19 pages, 1976

This planning program is intended to guide management in the industry towards the establishment of a fire precau-

tions system and the setting up of checking procedures to ensure that the system is maintained. Following a description of some significant fires to illustrate the cost of fires in the printing industry, the following sections are considered in outline and descriptive form: how the fires start and spread; hazards and precautions in various operations; storage; flammable liquids; preparatory processes, such as hot metal composition, photosetting, etc; printing — letterpresses and offset litho; printing — gravure and flexography; printing — silk screen; and bindery and finishing. The fire prevention measures to be taken, reporting procedures, routine checks, etc take up the final portion of the monograph. Diagrams and charts are provided.

2168. Anon

RESEARCH IN THE FIELD OF SAFETY ENGINEERING IN THE CHEMICAL INDUSTRY

[Issledovanie v Oblasti Tekhniki Bezopasnosti v Khimicheskoy Promyshlennosti]

VNII Tekhn Bezop Khim Prom, Moscow, USSR; 111 pages, 1976 (Russian)

The results of research carried out in the field of fire and explosion hazards of materials, the protection of equipment from destruction, and elimination of the hazard of electrification of materials are presented in this anthology of papers from the All-Union Research Institute for Safety Engineering in the Chemical Industry (USSR). Some papers are devoted to industrial health supervision and methods of analyzing the ambient air, determining the causes of industrial injuries and occupational diseases, developing new types of special protective clothing, etc. (RZh)

2169. King R

ALONE AT SEA YOU ARE YOUR OWN FIRE BRIGADE

Engineer (London); 242(6283/4):40-41, 1976

The fire on a production platform in the North Sea brought home to oil companies the need to 1) check the rates at which their offshore structures are corroding and 2) take a closer look at firefighting and detection methods. Fire protection equipment on offshore platforms is similar to but more highly automated than for similar land installations and is a totally self-complete system. The fire hazards on platforms arise from the leakage and ignition of hydrocarbons. The differences between offshore and land facilities are outlined, as is the classification of platform areas. Protection measures may be passive, through the use of fire and blast walls and fireproofing of structural steel, or active through the use of water sprinklers, spray deluges, foam, halon gas, dry powder systems, water reels and hand extinguishers of various kinds. The fire detection system and extinguishers are described. A synopsis of the hazardous and safe positions on an oil rig is given in an insert. 1 photo.

2170. Chinnock JHJ

PRE-PLANNING FOR SAFETY IN INDUSTRY

Fire Eng J; 36(104):25-27, 1976

The ways in which industry can make the best use of safety-trained and safety-conscious professional fire-brigade personnel and the steps it should take by planning to provide industrial safety are considered. Interchange

6. FIRE SAFETY

d. Industrial Occupancies—Continued

of training between local fire authorities and industries; consultation with fire brigades; accident prevention by safety planning through elimination of hazards; application of engineering techniques, and education; location of industries away from highly populated areas; segregation of high- and low-risk facilities; fire-safety design of installations with built-in precautions and fire-fighting facilities; and emergency planning, that is, preplanning fires, are some of the suggestions for industrial fire safety discussed in this paper presented at the Institution of Fire Engineers conference at Harrogate (UK) on 11-12 Oct, 1976.

2171. Anon

FIREFIGHTING AND WORKSHOP VESSEL*Hansa*; 113(13):1170, 1976 (German)

The remodeling of the tanker ship "British Kiwi" as a firefighting and workshop vessel for offshore operations in the BP Forties Field is described in brief. The firefighting equipment includes three remote-controlled monitors with a capacity of 1,450 m³/h each. 1 photo.

2172. Husset M-J

AUTOMATIC FIRE PROTECTION INSTALLATIONS*Ind Tech*; (318):93, 95, 97-98, 101, 104, 107-108, 111-112, 115-116, 119-120, 1976 (French)

The various kinds and types of automatic fire detection and extinguishing systems used in France are described. The absolute necessity of using automatic systems for modern industrial plants is emphasized. 32 figs.

2173. Kurimoto I

PRESENT STATUS AND OUTLOOK FOR INCREASING THE FIRE SAFETY OF FACTORY EQUIPMENT*Kagaku Kogyo*; 20(8):85-88, 1976 (Japanese)

It is pointed out that the trend toward increasing complexity of production equipment imposes more requirements on the effectiveness of fire protection systems and their various secondary parameters. Under such conditions, a strict correlation must be maintained between the number of instruments, the number of optical and acoustic indicator systems and their design features, and the requirements of normal reception or concentration of attention by the operator. Failure to achieve this correlation leads to difficulties in making an operational decision in emergency situations and, hence, to fires, explosions, and other accidents with serious consequences. Examples are cited and analyzed of cases when the failure to match the technical design of an apparatus to the potentials of human psychology in some modern petrochemical plants in Japan resulted in some major fires. The outlook for the development of the man-machine (ergonomic) sciences is mentioned in this connection. 3 figs, 1 table. (RZh)

2174. Tato H

FIRE EQUIPMENT*Kuki tyowa to reito*; 16(6):97-129, 1976 (Japanese)

The tactical characteristics and parameters and a description of the design and operating principle of several fire safety systems used in industrial plants in Japan are presented. Diagrams and parameters of automatic control devices used in various manufacturing processes that add significantly to fire safety are considered. Given in particular are the parameters of automatic control of the

thermal regimes of a gas-fired industrial furnace and the operating principle is explained. The purpose of the control system is to maintain a prescribed ratio of gas and air supplied for combustion. The system includes a jet servo control unit and an actuator assembly in the form of a hydraulic piston servomotor. Gas is supplied to the burners of the furnace through one pipeline, air through another. Measurement diaphragms and data sampling tubes connected to the respective membranes of the regulator are mounted in the pipes. Consequently, a force equal to the pressure differential in the diaphragms of the pipes acts on each membrane. When conditions on the membranes are uniform, the jet tube of the servo control unit is in the middle position and the piston of the servomotor is stationary. This system situation corresponds to the steady-state mode of furnace operation. When the gas flow rate increases, the pressure differential in the diaphragm of the pipeline increases. In this case the force acting on one of the membranes is greater than that acting on the other. This results in depression of the first membrane and displacement of the jet tube connected to the membrane. As a result, the pressure on one side of the servomotor piston increases. The piston travels to the opposite side and the throttle valve on the air conduit opens. The increase in the air flow rate results in an increase in the force acting on the membrane. The system resumes the equilibrium state only when the previous ratio between the gas and air flow rates is established. Also described is the automatic temperature control system in industrial gas furnaces, in which chromel-kopel thermocouples connected to a universal automatic potentiometer with output connected to a multi-trace recorder are used as the temperature sensors. 2 figs. (RZh)

2175. LeMar R

PROPER MAINTENANCE PRACTICES FOR FIRE-RESISTANT HYDRAULIC FLUID SYSTEMS*Lub Eng*; 32(10):539-541, 1976

Fire-resistant hydraulic fluids provide industry with a valuable safety factor whenever ignition sources, with consequent fire hazard, are present in the work area. When these fluids are correctly selected and maintained, their performance is as good as or better than that shown by petroleum oils. However, maintenance engineers often have problems with them. These problems usually originate from lack of knowledge of differences between these fluids and petroleum oil. Proper selection and use of the fluids require consideration of the following factors: 1) fluid types and their problems; 2) maintenance of fluid quality during use; and 3) hydraulic system design and operation. These three factors are discussed in detail in the article. (Author)

2176. Wakabayashi K

ANALYSIS OF FIRE-PROTECTION SYSTEMS USED IN INDUSTRY*Netsu Kanri To Kogai*; 28(4):40-47, 1976 (Japanese)

It is pointed out that the reliability and efficiency of fire-protection systems used in large modern industrial installations must be increased. It has been calculated that the complexity of such systems has increased on the average by a factor of 5 to 10 in the last 20 years owing to continuous improvement, and for this reason the problem of increasing their reliability is urgent. Analytical

6. FIRE SAFETY

d. Industrial Occupancies—Continued

formulas governing the methods of verifying the reliability parameters of complex automatic fire-fighting systems under operating conditions are given. It is stated that the use of statistical methods to check such systems is most promising, because these systems, as a rule, are designed with a large number of standard components that can serve as prime objects for checking the reliability of operation and stability of characteristics. These components are sprinkler heads, fire detectors, automatically controlled pipe valves, etc. The standard methods for conducting such tests and their theoretical principles, which are given, are based primarily on the use of the theory of graphs, in particular, branching methods (fault trees), to determine the shortest and cheapest ways of finding and eliminating faults. Block diagrams of the reliability of several of the most widely used types of fire-protection systems are given. 13 figs, 15 refs. (RZh)

2177. Ishikawa M

FIRE SAFETY MEASURES IN INDUSTRIAL PLANTS*Puranto Enjinia*; 8(7):40-44, 1976 (Japanese)

Statistical data characterizing the number and nature of fire and explosion incidents in a number of large Japanese enterprises are presented. Some of the modern fire safety systems used in individual industries are described. An automatic industrial gas analyzer works as follows. Samples entering the sensor of the analyzer are tapped periodically to check the atmosphere of an enclosure. If the gas concentration is hazardous, the sensor pulse is converted into a signal that automatically triggers the ventilation system, a siren, and a light panel. The fire protection of a transformer substation is also described. The transformer has an air-cooling system regulated by louvers. The oil bath of the transformer has a thermoresistor tuned to a certain temperature threshold. As soon as the transformer temperature reaches this limit, the thermoresistor cuts in the ventilation system. The visual and acoustic signals are triggered simultaneously with the ventilator and the transformer supply system is disconnected. If a fire breaks out, the safety device melts and the ventilator is shut off, the louvers are closed, and a valve for supply of carbon dioxide or nitrogen into the premise through a pipe distribution line is opened. One version of this system is designed for the fire protection of a transformer substation located in the immediate vicinity of production equipment. It includes an automatic ventilation system that provides for pressurization of the air in the premise, preventing the intake of gas and air mixtures into the transformer substation and, consequently, ignition of this mixture by contact with sparks or overheated metallic parts. Some specific recommendations on the introduction of advanced fire protection devices in industrial plants are made. 2 tables. (RZh)

2178. Dzura M and Ostrowski T

CENTRAL CHEMICAL SAFETY STATION*Prz poz*; 64(6):17-20, 1976 (Polish)

In recent years a number of large-scale accidents have occurred in chemical plants in Poland. Rescue teams and emergency services have been set up to eliminate accidents in Bydgoszcz, Pulawy, Tarnow, Plock, and Brzeg-Dolny. In order to coordinate the activity of the rescue teams, to carry out training and research, and also to disseminate technical and economic information, a Central

Chemical Safety Station is being set up at the Mazovetsk Oil Refinery and Petrochemical Plant. The mission of this station is to solve the problems of interaction between rescuers, fire protection, technical and medical services, and the police and coordinating the activities of the different organizations engaged in rescue work. The station has the following sections: operations, technical, supply and transportation, medical, administrative and training. The sphere of activities of each section is being examined. The operations section is entrusted with receiving reports on accidents, allocation of resources and rescue means, in accordance with the safety plans, ensuring communications with teams at the accident site, etc. The technical section performs the following functions: study of the physico-chemical properties of harmful and hazardous vapors and gases, the possibility of utilizing the harmful materials, study of fire-extinguishing and neutralizing agents, ways and means of handling accidents, experimental study of means and devices, and training the personnel operating these devices during emergencies. A diagram of the training area is given. The training section is equipped with the most modern training aids. The medical section is engaged in studying the health of rescue workers, occupational illnesses, and rendering first aid to victims. 5 figs. (RZh)

2179. Ivanov A

VORONEZH TIRE FACTORY (FIRE SAFETY)*Pozhar delo*; (6):14-15, 1976 (Russian)

The work of the plant and workshop fire-engineering teams, which is aimed at increasing fire safety, is reported in the article. The teams conduct quarterly inspections of the workshops and storage areas, train the workmen and employees in fire safety measures, and study the fire-hazard properties of new substances and materials. A particular task of the teams is the introduction of innovative proposals aimed at reducing the fire hazard of production processes and improving the fire safety of storage areas. (RZh)

2180. Kitagawa T

PROPOSALS TO PREVENT PLANT EXPLOSION ACCIDENTS*Puranto Enjinia*; 8(7):17-23, 1976 (Japanese)

An analysis is made of the most typical causes of fires and explosions in industrial enterprises, and recommendations are made on increasing the fire and explosion safety for a number of chemical production processes. In particular, a description is given of a new complex safety system especially developed for machinery producing cyclohexane used in plants manufacturing nylon and other synthetic fibers. The complex system includes the following assemblies: a subsystem for automatic supervision of the working concentration of a mixture of combustible gas and oxidizer; a subsystem of automatic gas-ratio regulators maintaining the required fire- and explosion-safe concentration of the mixture of combustible gas and oxidizer in the feed lines; a subsystem of fixed gas analyzers that automatically signal any deviation in concentration from the norm; an automatic subsystem that cuts off the supply of gas to an apparatus when the required concentration is exceeded and, simultaneously, introduces an incombustible gas or retarding additives into the system. The system provides for partial mutual takeover of the func-

6. FIRE SAFETY

d. Industrial Occupancies—Continued

tions of its subsystems. This principle of partial duplication of functions also ensures maximum operating safety of large production machinery and is recommended for safety systems being developed for analogous industrial apparatus used in various plants of the chemical industry. 4 figs, 2 tables, 7 refs. (RZh)

2181. Sawaki Y and Nishikawa K
STEPS TO ENSURE SAFETY IN MANUFACTURING
Puranto Enjinia; 8(5):41-48, 1976 (Japanese)

Examples of ensuring the fire safety of large unenclosed manufacturing machines are presented. In particular, the design and operating principle of the automatic fire extinguishing system of open reactors for the production of caprolactam are described in detail. The system automatically detects the seat of a fire occurring on the surface of the reaction vessel or when hot liquid overflows onto the floor beneath the vessel and initiates a fire alarm signal, at the same time actuating the supply of extinguishants. The automatic detection system consists of electrical rate-of-rise fire detectors, which respond to a difference (increase) in temperature, and sprinkler heads with low-melting locks located along the pipelines, which are filled with compressed air or nitrogen. When a fire breaks out, the fire detectors or sprinkler locks are triggered. The fire alarm is actuated automatically, as are the control and initiating assemblies through which water and foam concentrate are supplied. The system contains a foam agent proportioner. The mechanical foam consists of a 5% aqueous solution of foaming agent in a foam generator. Some advanced methods of preventing other types of accidents in plants of the chemical and pharmaceutical industry are also reported. 2 figs. (RZh)

2182. Umehara T
METHODS OF PREVENTING FIRES IN PETROLEUM PLANTS
Puranto Enjinia; 8(7):29-32, 1976 (Japanese)

The status of fire safety in plants of the Japanese petrochemical industry is briefly evaluated. Statistical data characterizing the magnitude and nature of the material losses from some large fires in petroleum storage installations in the last five years are presented. The outlook for increasing fire safety in this branch of industry is discussed; in particular, a graphic plan of a number of organizational and engineering measures that are to be taken to increase the fire safety on a nationwide scale is given. The principal measures provide for training and the solution of problems in the following areas: reducing the fire hazard of materials used in production; improving production processes and equipment by improving the smoothness and continuity of these processes; expanding the use of new stable corrosion-resistant and incombustible materials, including plastics, organosilicon compounds, etc; introducing highly effective protective devices to guarantee fire safety, such as lightning protectors, grounding devices, safety valves, etc; perfecting supervision of the status of production-line equipment; and rigorous maintenance of production in accordance with the existing regulations. This plan is designed to cover five years. Also discussed in brief is the organization of methods to supervise fulfillment of the plan by the individual companies of the Japanese petrochemical industry. 1 fig, 2 tables. (RZh)

2183. Damel R
FIRE PREVENTION AND PROTECTION IN INDUSTRIAL ESTABLISHMENTS
Rev Tech Feu; 17(157):48-51, 1976 (French)

It is noted in a paper presented by the Representative of the French Technical Fire Safety Council at the National Research Institute that the number of fires in industry and the losses from them are growing continuously. In France there are fires in 5,000 industrial establishments annually; the number of fires with losses greater than 5 million francs has increased from 13 in 1969 to 45 in 1974; the losses from these 45 fires (610 million francs) exceeded the losses from 5,000 fires in 1969 (540 million francs). The main aspects of the fire hazards of industrial plants are analyzed. Recommendations are advanced for ensuring the fire safety of premises.

2184. Thomas CL
FIRE PROTECTION IN AUTOMATED TEXTILE MACHINERY; Paper No. 6/1-3
Textile Industry Technical Conf, Annual, Proc; 1976, May 6-7, Atlanta, GA
Sponsor: IEEE

This paper discusses the problems encountered in detecting and controlling fire in automated textile machinery and stock transfer ducts and lists some of the successful and unsuccessful approaches to the solution of these problems. Such solutions include thermal, smoke, ionization, and optical types of fire detection equipment and the reasons for the use of each. Also included are points concerning water, CO₂, Halon and dry chemical extinguishing agents. (Author)

2185. Lemke E
EDUCATION OF SAFETY ENGINEERS
VFDB Z; 26(1):19-22, 1977 (German)

For some years a course on machine-construction operations, with emphasis in the areas of labor protection and occupational safety, hazard reduction and loss prevention, and general operations engineering, has been offered in the field of machine construction at the Berlin Technical University, along with courses on machine design and production. The syllabus of this course of study, the individual course phases, and the scheduling are presented. The development of course materials for correspondence courses is discussed. 3 figs. (Fachdok 13/0389)

2186. Buecher fnu
FIRE PROTECTION IN ELECTRONIC DATA PROCESSING FACILITIES
Werkfeuerverband eV. Rundschreiben; (95):2-4, 1977 (German)

The two principal reasons for carefully planned fire-protection measures in electronic data processing centers are mentioned: 1) the high power requirements during operation and the readily combustible equipment materials; 2) the high concentration of valuable property in a small area. To date the most frequent causes of ignition were negligence on the part of the personnel and faults in the electrical system. As a result of these findings, a large catalogue of structural fire-protection measures has been compiled, which is being supplemented by special operational protective measures. (Fachdok 13/0388)

6. FIRE SAFETY

d. Industrial Occupancies—Continued

2187. West PT
WASH TANK TREATING CAN SAVE FUEL, REDUCE FIRE HAZARDS
World Oil; 183(2):35-39, 1976

In some producing areas, the wash tank method of separating oil emulsions can be an attractive alternative to use of direct fired heaters. Primary considerations are safety, simplicity of operations, and conservation of fuel gas. Conversely, the large long-retention-time systems must be closely evaluated for gas handling abilities, corrosion maintenance, and chemical costs. This article presents some useful designs for wash tank systems, including schematic drawings of internal features and typical basic calculations. The pros and cons of wash tank versus heater treaters are discussed. 6 figs, 4 refs. (Author)

e. INSTITUTIONAL OCCUPANCIES

2188. Meyer E
FIRE HAZARDS CONNECTED WITH HEAT-TRANSFER OIL
Brandschutz; 30(12):336, 1976 (German)

A few of the many shortcomings of heating plants with heat-transfer oils are pointed out. At the present time the safety of such plants leaves much to be desired. Before a heat-transfer oil plant for heating circuits in hospitals and other buildings containing large numbers of people, such as schools, halls, etc., functions correctly, many safety regulations must be met, so that the success of the plant rests not only in the thermal efficiency and economy, but also in the safety-engineering aspects of protecting the people living or working in them. 1 fig. (Fachdok 13/0303)

2189. Pieper H
AUTOMATIC FIRE DETECTION EQUIPMENT IN HOSPITALS
Krankenhaus Umsch; 45(9):653-654, 1976 (German)

The importance of the earliest possible warning of a fire outbreak in a hospital is stressed and two types of automatic detectors are described and illustrated: the ionization smoke detector, which contains a very weak radioactive substance that is affected by the penetration of smoke and actuates the alarm; and the rate-of-rise detector, which is actuated when the temperature increases by more than 10°C in a minute or when 70°C is exceeded. The air-conditioning plant must be continually monitored for smoke, as it can spread smoke to other parts of the building. Press button alarms are also useful. Detection systems are linked to a central fire alarm point that must have a direct link to the public fire service.

2190. Przybilla L
HOSPITAL FIRE PREVENTION REGULATIONS
Krankenhaus Umsch; 45(9):646-648, 1976 (German)

Effective fire protection in hospitals requires that all fire prevention regulations are fully observed and that, if a fire occurs, rescue and firefighting measures are expedited and supported. This paper gives the text of the fire protection regulations in force at the 392-bed Marien Hospital, Essen (FRG). These regulations are made known, on appointment, to each staff member, who signs a form to say that he has read them. They cover fire

prevention duties, location and use of equipment, and behavior during an outbreak (including giving the alarm, firefighting, care of patients, and rescue work). An appendix lists the West German acts, regulations, orders, guidelines, and standards concerned with fire protection.

f. MINING

[For more complete coverage of the mining literature see **SMRE Safety in Mines Abstracts (UK)**.]

2191. Kushnarev AM, Lapin KI, Korzhov VT and Sergienko VI
FIRE PROTECTION OF EXCAVATING RIGS USING WATER-SPRAY SYSTEMS
Gornospasat delo; (13):3-6, 1976 (Russian)

The design of an automatic water-spray system for the suppression of fires in long working faces equipped with excavating rigs is described. The results of field tests are given. (RZh)

2192. Bolbat IE and Lebedev VI
STOPPING THE MAIN VENTILATION FANS DURING UNDERGROUND FIRES
Ugol; (9):58-60, 1976 (Russian)

Calculations and observations show that although the overall natural draft of mines deeper than 500 m throughout the year is, as a rule, in the same direction as the depression of the fans of the main ventilation system, the natural draft in shafts not infrequently changes directions even in the course of one day. In such cases, when the main ventilation fans are stopped, very often the air flows recirculate, resulting in contamination of all the mine workings with combustion products. It is concluded that the main ventilation fans must not be stopped during fires, not only in vertical and inclined workings, but also in horizontal ones. If they are forced to stop, special measures to prevent or reduce recirculation of the air flows must be taken. 4 figs, 4 refs.

g. POWER PLANTS

2193. Anon
TESTS WITH A FIRE-RESISTANT FLUID IN THE LUBRICATING AND HYDRAULIC SYSTEM OF A STEAM TURBINE
Maschinenschaden; 50(1):19-20, 1977 (German)

Since fires from turbine oil leakage have caused considerable damage in recent years, the idea of replacing mineral lubricating oils by synthetic fluids with a higher ignition point has been resurrected. Positive laboratory tests of phosphate esters as lubricating agents are available from the United States, but adequate operational trials are as yet unknown. For this reason, tests were carried out in one of the steam turbines of the heating plant of the Technical University of Munich. The results are reported in this article. 20 refs. (Fachdok 13/0466)

2194. Steinbauer E
SAFETY AND FIRE PROTECTION MEASURES IN REMOTE-CONTROLLED PLANTS
Oesterr Z Elektrizitaetswirtschaft; 29(6):253-258, 1976 (German; English and French Summaries)

6. FIRE SAFETY

g. Power Plants—Continued

For reasons of economy and operational convenience, remote control of transformer substations and power plants from central control points or master stations has become common practice. The fact that these stations are unmanned, however, has resulted in various safety and fire protection problems. The solutions found for problems in the particular case of the STEWEAG, the electrical supply system of the Province of Styria, Austria, is described in detail following a description of the basic layout of the remote control system. On the basis of the example of the new control center in Graz, it is shown that integrated remote-control stations even offer certain advantages from the safety-engineering standpoint in that multiple supervisory controls are possible. 10 figs, 1 ref.

h. PUBLIC BUILDINGS

2195. Elifani G

RESTRICTIONS ON THE USE OF SOME MATERIALS IN PUBLIC BUILDINGS*Antincendio protez civ*; 28(4):259-261, 1976 (Italian)

Recently articles made from plastics have been widely used in construction as facing, decorative and insulating materials. But the large number of fires with losses in human life have made it necessary to take a critical look at the use of plastics in construction, especially in public buildings. The particular fire hazard of plastics is the high toxicity of the smoke and gas they release during combustion. In addition, some plastics (polyvinylchloride, polyethylene, polypropylene, etc) melt at a comparatively low temperature (135-160°C), which is one of the causes of fire spread if the fire breaks out in the upper part of an enclosure and burning particles drop on the floor. Some kinds of plastics (polystyrene and polyurethane) have a high rate of fire spread. In this connection, the standards in effect in Italy classify plastics by their degree of flammability, ignition point, melting tendencies, and rate of fire spread: (M0) — noncombustible; (M1) — non-flammable; (M2) — difficultly flammable; (M3) — moderately flammable; (M4) — readily flammable; and (M5) — very highly flammable. In accordance with the classification of plastics for different public buildings (restaurants, hospitals, etc), certain classes of plastics can be used, depending on the number of people occupying a premise at the same time, the number of floors, etc. The existing standards also limit the amount of plastics that can be used for m³ of area. 6 refs. (RZh)

2196. Anon

PROTECTION OF REST HOMES, NURSERIES, NURSING HOMES, HOTELS AND BOARDING HOUSES*Electro Rev*; 68(28):705-706, 1976 (German; French)

Under supervision of the TNO Materials Testing Institute (the Netherlands) tests were carried out in Arnhem to determine the development of fires in rest homes, hotels, boarding houses and the like. Of particular interest in this connection was the question of the CO level in rooms at which it is required to awaken sleeping occupants via alarms or to rescue them from the outside. Ionization, optical and rate-of-rise detectors, as well as sprinkler nozzles, were tested. It was found that ionization detectors best fulfilled the requirements of protection for such institutions. 2 figs.

i. RESIDENTIAL OCCUPANCIES

2197. O'Hagan JT

HIGHRISE/FIRE AND LIFE SAFETY; 288 pages, 1976
Dun Donnelley, NY

The hard-earned lessons of highrise fires are told by the New York State Fire Commissioner. The author provides the foundation for readers to develop the necessary skills to deal successfully with highrise fires. The book details the concepts and criteria that have been developed to build safe highrise buildings and to fight fires in them. The experience of the author will help to identify and correct conditions which could contribute to large fires and loss of life. The individual chapters are as follows: Evolution of the Highrise Building; Today's Highrise — Central Core, Thin Skin; Full-Scale Fire Tests in a 22-Story Building; Organizing the Building's Resources; Structural Features — Effect on Fire; Basic Fire Fighting Strategy; Strategies Used at Actual Fires; Tactical Command at the Highrise Fire; Highrise Holocausts in South America; and The Residential Highrise. The text is provided with 125 photographs, two-color line drawings, charts and diagrams.

j. TRANSPORTATION (Air, Rail, Road, Water)

2198. Lauriente M and Wiggins JH

A NATIONAL PROGRAM FOR FIRE SAFETY IN TRANSPORTATION*Transportation Conf, Intersociety, 4th, Papers*; 1976, Jul 18-24, Los Angeles, CA

Sponsor: Intersociety Committee on Transportation

Fire is one of the many hazards that must be addressed within the concept of transportation safety and all its ramifications and influences on the other vital concerns of the nation. It is the purpose of this paper to outline a methodology based on risk analysis, technology analysis and policy analysis techniques to meet the requirements of the Secretary of Transportation. The methodology and the current conflicting policies that support the need for such a new policy development are demonstrated.

2199. Hunt WR

THE SPECIAL PROBLEMS OF FIRE PREVENTION AT VICKERS SHIPBUILDING*Fire Prev*; (118):16-20, 1977

Vickers Ltd Shipbuilding Group at Barrow-in-Furness, UK, is the largest single employer of labor in Cumbria, with a workforce of some 14,000 men and women. The site consists of an engineering complex of 62 acres and a shipbuilding area of 78 acres, together with a 27-acre dock system. There is also an airfield some 2 miles from the main works. Each of these is covered by units of the main-works fire brigade. This article deals only with the special problems of the shipbuilding section. The fire hazards, grouped under the 4 headings of: 1) the variety of vessels built; 2) changes in the methods used, especially in hot work operations; 3) the continuous increase in a vessel's fire load during the course of its construction; and 4) the problems arising from the materials employed, are discussed first, followed by an outline of the fire service, its contact with the local fire brigade and the Royal Navy, the fire prevention committee, fire problems, shipboard precautions and equipment, training, contingency planning, and fire exercises. 7 photos.

6. FIRE SAFETY

j. Transportation (Air, Rail, Road, Water)—Continued

2200. Smith JRG

FIRE SAFETY IN SHIPS: A REVIEW OF INTERNATIONAL REGULATIONS; SUGGESTIONS FOR IMPROVEMENT IN FIRE SAFETY EQUIPMENT*Safety Sea Internat*; (89):20-23, 26, 1976

The processes for the development and introduction of international marine fire safety regulations result in a delay of some considerable time before they become mandatory. Hence, the applicable regulations tend to lag behind current knowledge and experience and contain deficiencies in that light. The objectives of this article are as follows: to point out some of the deficiencies in existing applicable fire safety regulations; to draw attention to amendments that have been developed to remedy these deficiencies, but which have not yet been adopted internationally; to urge that those amendments be adopted, if necessary, on a voluntary basis before they become mandatory; and to suggest further improvements that could be made to the regulations, some of which could be adopted immediately and at relatively little cost. 2 figs, 2 tables, 3 refs. (Author)

2201. Anon

FIRE FIGHTING TRAINING — AN EXERCISE IN SURVIVAL*Safety Sea Internat*; (89):7-8, 1976

Losses due to fire on ships are decreasing, and most of those recorded are in ships sailing under the more irresponsible flags of convenience. The decline is the fruit of the improved education of the seafarer in fire hazards, minimization of fire risks on board ships, and in practical experience gained by the seafarer under trained fire officers at well-organized, ship-oriented courses ashore, which are mandatory for candidates seeking the British Certificate of Competency. The ship emergency plan, prominently displayed in several places around the ship, provides all the information needed for emergency situations. Specialized companies are experts at designing a firefighting system geared to a particular ship's needs and overseeing installation. Manuals are available regarding fire hazards of cargoes and proper method of storage. This situation is contrasted with the past experience of a fire incident dating from the 1880's. 1 fig.

2202. Koboyashi H

FIRE SAFETY REGULATIONS FOR UNDERGROUND RAILWAYS*Tetsudo Doboku*; 18(4):265-268, 1976 (Japanese)

Light is shed on a number of problems connected with ensuring fire safety in underground railways, in subway systems and tunnels. It is stated that the greatest fire hazards are tunnel sections of multi-track railways powered by a d-c rail of up to 30 kV. Such railways are widespread in Japan; the total length of such tunnels is 6,000 meters. Subway trains in Tokyo are also powered by a d-c contact rail, and therefore the same fire-safety requirements are valid for both types of transit. The principal requirement is fully automated fire detection and shut-off of the power source over the affected section of the line when a fire breaks out. Recommendations are made on the use of specific fire detection and extinguishing systems, as well as on the choice of heat-resistant electric power cables for electrical commutation in tunnels

and of fire-retardant paint and varnish coatings for tunnel and car walls and fittings. Also presented is a model regulation for various kinds of fire-fighting measures, both organizational and technical, eg, preventive inspection of equipment, training of service personnel, etc. (RZh)

2203. Hill R, Boris PN and Johnson GR

AIRCRAFT CABIN COMPARTMENTATION CONCEPTS FOR IMPROVING POSTCRASH FIRE SAFETY.

Nat Aviat Facilities Experim Center, Atlantic City, NJ; FAA NA-76-12, FAA RD-76-131, 74 pages, Oct 1976
Availability: NTIS AD-A033 051/4GA

Aircraft cabin compartmentation was investigated as a means of increasing escape time for passengers during a postcrash cabin fire. The size and configuration of various partitions and/or curtains were investigated to determine their effectiveness in providing protection from a cabin fire by limiting the spread of heat, smoke, carbon monoxide (CO), and the depletion of oxygen from the vicinity of the fire to other areas of the cabin. The results of these tests indicated that a tightly sealed partition and/or curtain afforded the greatest protection from the spread of a given amount of heat, smoke, CO, and depletion of oxygen. The results also indicated that the use of compartmentation can adversely affect the intensity of a fire in an unclosed area, creating more products of combustion. Except for a limited number of cases, the amount of protection provided by the partition exceeded the increase in fire intensity. (Author)

7. FIRE SERVICE ORGANIZATION AND FACILITIES**a. ADMINISTRATION, ORGANIZATION AND MANAGEMENT**

2204. Konig A

DO YOU NEED AN ANALYST?*Fire Command*; 44(1):16-17, 1977

The Chief of the Vancouver Fire Department, British Columbia, Canada, describes his experiences in searching for a fire department analyst and the requirements for such a position, the chief ones being: skill in using mathematics as applied to engineering and research computation; the ability to readily acquire knowledge of fire department operations and equipment and the principles of fire protection and prevention; and application of the general principles of systems analysis and engineering to specific fire department problems.

2205. Townley JP

INCREASING PRODUCTIVITY*Fire Chief*; 21(3):36-38, 1977

Fire prevention activity, including an inspection program, public education, training, fire/rescue service, fire safety patrolling, addition of the Rapid Water system, and code enforcement are some of the ways in which firefighter productivity can be increased to reduce fire losses and to help hold municipal budgets to a reasonable level.

FIRE TECHNOLOGY ABSTRACTS

7. FIRE SERVICE ORGANIZATION AND FACILITIES

b. EDUCATION AND TRAINING

2206. Robertson WD

HOW DO YOU KEEP THEM READY?

Fire Command; 44(1):18-21, 1977

The Superintendent of Operations of the Seattle, WA, Sea-Tac International Airport describes the recruit training program, coupled with a well-rounded retraining schedule, to maintain a highly satisfactory level of proficiency in fire-fighting personnel. These training and retraining programs, in conjunction with maximum use of personnel in such activities as inspection and control of the airport water distribution system, satisfy the two challenges of prime concern to chief administrators of an airport fire department, namely, to train fire-fighting personnel to a high state of readiness and to maintain suitable interest and alertness within each member of his department.

2207. Graham CH

TRAINING AND SAFETY IN THE FIRE SERVICE

Fire Eng J; 36(104):29-31, 1976

The areas where dangers exist for the firefighter, namely, the station and its environs, the station's fire coverage area, and the fireground and accident scene, are first identified, and then the concept of "safe person/safe place" as an approach to the safety problem is discussed. The present tendency is to move away from the "safe person" approach toward the "safe place" approach, because the latter is more readily identifiable and its benefits and results are quantifiable, whereas the pay-off from safety training in the "safe person" approach is said to be comparatively less effective and profitable. The Fire Service training procedures, embodied in its Code of Safety Practice, are outlined, and the need for continuation training is emphasized. The relaxation in the "safe person" approach that occurs when too much emphasis is placed on the "safe place" approach is identified as an additional danger. (This paper was presented at the Institution of Fire Engineers Conference at Harrogate (UK) on 11-12 October, 1976.)

2208. Richards DR

REDUCING THE RISKS IN A FIREMAN'S WORK

Fire Eng J; 36(104):21-24, 1976

Ways in which firemen must be prepared at each stage of training to enable them to contribute to their own safety and that of their team are put into perspective. Risks are identified, objectives relating to individuals and the environment (the safe person/safe place concept), UK legislation, training, accidents and their prevention, breathing apparatus, leadership, and the UK code of safety practice for the fire service are the topics discussed in this paper, which was presented at the Institution of Fire Engineers conference at Harrogate (UK) on 11-12 October, 1976. 1 fig.

2209. Dallman BE and DeLeo PJ

EFFECTIVENESS OF SMOKE ABATED TRAINING IN SIMULATED CRASH FIREFIGHTING. Brooks AFB, Air Force Human Resources Lab, TX; AFHRL TR-76-60, 39 pages, Aug 1976

Availability: NTIS AD-A034 843/3GA

Concern for the environment has resulted in the development of a water spray apparatus that can greatly reduce the smoke associated with aircraft crash fire simulations used in firefighter training. This study compared the effectiveness of smoke-abated training with conventional procedures. Results showed no significant differences between students trained under smoke-abated conditions and those who experienced natural, or smoky, fires during training. However, students who had received smoke-abated training were less confident and more unsure of the effectiveness of their training than conventional students. It was concluded that smoke-abated training can be an effective method for training for protection specialists with certain constraints. Recommendations regarding employment of the smoke-suppression apparatus are provided in the report. (Author)

c. FACILITIES

2210. Hall E and Torregas C

A NEW TOOL TO SELECT FIRE STATION SITES

Fire Chief; 20(11):36-38, 1976

A computer has been developed to assist in the process of fire station location based on actual travel times on existing city streets, taking into account traffic congestion, one-way streets, hills, etc. The program has been supplemented to include results in computer-drawn maps showing land use, fire incidents, transportation network, and actual response times. The methodology consists of several data collection forms, computer programs, and manuals to help each municipality solve its own fire protection problem. 4 figs.

2211. Hildebrand FC

POLLUTION CONTROL AT NAVY FIRE-FIGHTING SCHOOLS

Mil Eng; 68(442):100-101, 1976

An essential element in the training curriculum of firefighters is exposure to actual or simulated fires, which, for the Navy fire-fighting schools, has been accomplished in ship mock-up structures, in which various petroleum fuels producing large quantities of smoke are ignited. To combat the nuisance of smoke to the nearby civilian population, two smoke removal methods were investigated, the afterburner and water spray methods. The afterburner system collects the smoke-laden gases and heats them to a minimum of 1,500°F for thermal oxidation. The water-spray technique uses an atomized water spray injected over the surface of the burning oil in conjunction with an automatic ignition system. The training devices and the smoke-abatement systems used with them are described, as are other ongoing smoke-abatement studies. 2 figs.

2212. Goldsmith A

DEVELOPMENT OF SMOKE ABATED AIRCRAFT CRASH/RESCUE FIRE FIGHTING TRAINER. IIT Res Inst, Chicago, IL; IITRI J6339, NAVTRAEQUIPC-74-C-0152-1, 127 pages, May 1976

Availability: NTIS AD-A035 999/2GA

It was shown previously that liquid petroleum fuels can be burned from a free surface without smoke generation by injecting a water spray near the surface of the burning

7. FIRE SERVICE ORGANIZATION AND FACILITIES

c. Facilities—Continued

fuel. This program concerned the extension of this smoke-abatement method to aircraft crash/rescue trainers involving fire spread to about 3000 sq ft. Smoke-abated fires of realistic severity for training purposes were obtained using either JP-4 or automotive gasoline, while JP-5 and No. 2 diesel oil were found ineffective for this purpose. Field experiments proved the compatibility of smoke-abated JP-4 fires with extinguishment using aqueous film-forming foam. A detailed design is presented for a 50-ft diameter smoke-abated fire area for firefighting training, together with step-by-step procedures for its operation. (Author)

d. GENERAL EQUIPMENT

2213. Kugelman M
SAFETY WITH PRESSURIZED HOSE LINES
Brewers Digest; 51(6):44-46, 1976

When a hose line carrying pressurized steam, air, water or other liquids or gases breaks or blows off, the results can be both expensive and devastating. Many precautions can be taken by operators and maintenance men to reduce the potential for failure. Modern hose couplings and clamps are designed to provide maximum safety, but the use of the hardware is more critical to safety than is the hardware design. Simple pointers are presented to make pressurized equipment safer and its operation more efficient and less expensive. 6 figs.

2214. Longcroft T
FIRE ENGINE DESIGN — WHICH WAY?
Commer Motor; 143(3654):55-58, 1976

Cuts in government spending in the UK have caused Fire Brigades to take a closer look at replacement vehicle requirements. Many are turning to cheaper chassis derived from truck models rather than the specialist chassis. The average service life of a specialist-built chassis is 10 to 12 years, which compares well with that of the truck-derived chassis. The trend is toward volume-produced chassis on which modular body units can be mounted to produce a standard apparatus. The emphasis on easy driving leads to an automatic gearbox, leaving the driver's hands free to control the vehicle. A higher capacity rear axle is also required to cope with the extra torque. Also discussed are cab developments, rear engine location, wood frame and aluminum clad timber panels for bodies, and other aspects. 8 photos.

2215. Loeb DL
LARGE DIAMETER HOSE
Fire Chief; 20(11):39-44, 1976

In this third installment of a five-part series on large-diameter hoses, the larger sizes from 4 to 6 in., as well as the equipment, couplings, and fittings required to use the hose, are discussed. The hoses, supplier firms, water-hammer effects, tests with 5-in. hose, etc are described. (For preceding and subsequent installments by this author, see the author index.) 13 photos, 1 table.

2216. Loeb DL
LARGE DIAMETER HOSE
Fire Chief; 21(1):60-62, 64, 66-67, 1977

In this final fifth installment on large-diameter hose (LDH), the author discusses the facts and opinions resulting from a questionnaire sent to fire chiefs using such hose. Some of the questions asked were: How do you load your LDH? What type load do you use? How is LDH hose being used in urban firefighting? How many units do you have equipped with LDH? etc. 6 photos.

2217. Waters JM
SLEP — HOW TO BEAT THE RISING COST OF FIRE APPARATUS
Fire Chief; 20(11):33-35, 1976

A Service Life Extension Program (SLEP) for aircraft, involving modifying, updating, and repairing, has been adopted as an alternative to buying increasingly expensive new firefighting equipment. The SLEP experience of the Jacksonville, Florida, department is recounted. 2 photos.

2218. Kotov A
HIGH-EXPANSION FOAM GENERATORS
Pozhar delo; (10):28, 1976 (Russian)

Specialists of the Leningrad branch of the All-Union Fire Protection Research Institute (USSR) have developed, produced and tested four fan-type foam generators for foam with an expansion factor of about 1,000, two of which have been introduced into service in the district, one truck-mounted (GVPV-400) with an output of 400 m³/min, the other trailer-mounted (GVPV-250) with an output of 250 m³/min. The technical characteristics of these four generators are given in a table. These generators are recommended for the suppression of large-volume enclosure fires. 2 photos, 1 table.

2219. Sokolov V
FIREFIGHTERS ON THE KAMCHATKA PENINSULA
Pozhar delo; (11):10-11, 1976 (Russian)

The climatic conditions on the Kamchatka peninsula (USSR), namely, thick fog in the summer and snow cover in the winter, have left their mark on the organization of the fire service. The District Executive Committee has approved a plan for basic fire-protection measures. Attention is devoted in this plan to questions of both prevention and suppression. Particular emphasis was placed on equipment. Because of the high humidity, hoses have to be dried frequently, even when they are not used. Particularly important for the wintertime are high-mobility fire apparatus capable of carrying large quantities of water. These requirements are met by a fire apparatus made by local efficiency experts from the chassis of a T-34 tank. A 13 m³ watertank, a monitor, and an M-1600 motor-operated pump were mounted on the chassis. The fire-fighting tank has completely justified the funds spent on it. (RZh)

2220. Anon
FIRE-FIGHTING TUGS BUILT IN BELGIUM
Ship World Shipbuild; 169(3915):264-265, 1976

The particulars and two photographs of a series of four tugs constructed specifically to handle large tankers are given. The interesting feature of these tugs is their fire-fighting ability. Each tug has triple monitors with a capacity of 2,000 tons of water per hour. Two jets are mounted on a platform above the wheelhouse and a third on a

7. FIRE SERVICE ORGANIZATION AND FACILITIES

d. General Equipment—Continued

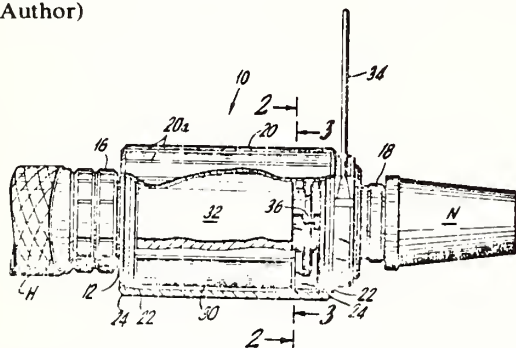
telescopic tower with a maximum extension of 24m above the waterline. A monitor-controlled oil slick gathering and dispersal system has been installed on board each tug. 2 photos.

2221. Bernstein JL and Kovach PE

FIRE HOSE NOZZLE COUPLER SWITCH

US Patent No. 3,943,312; Cl 200/61.58 R, (H01H 3/16), Appl 14 Feb 1975, Discl. 9 Mar 1976, Assignee: Grumman Aerospace Corp, Bethpage, NY

An electrical switch assembly includes a housing adapted to be coupled to a hose and nozzle to form a fluid passage therebetween. The assembly has a pair of reed switches that provide signal input to circuitry and each switch may be activated by the manual rotation of a sleeve. The sleeve carries a magnet to actuate the switch and may be rotated in either direction from a centered position between the reed switches. 6 claims, 4 drawing figs. (Author)

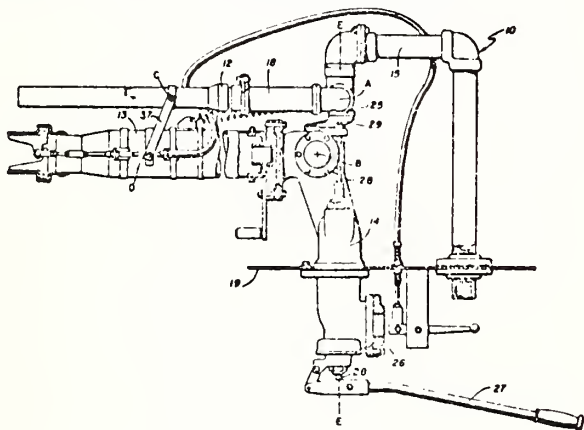


2222. Gagliardo JP

FIREFIGHTING TURRET

US Patent No. 3,989,109; Cl 169/24, (A62C 27/16), Appl 21 Jul 1975, Discl. 2 Nov 1976, Assignee: Feecon Corp, Westboro, MA

Disclosed is a fire-fighting turret including three 90° elbows arranged seriatim with swivel joints where the two end elbows are connected to the central elbow attached to a second turret in such a manner that reaction forces create no problem and the field of aiming is affected very little. 8 claims, 6 drawing figs. (Author)

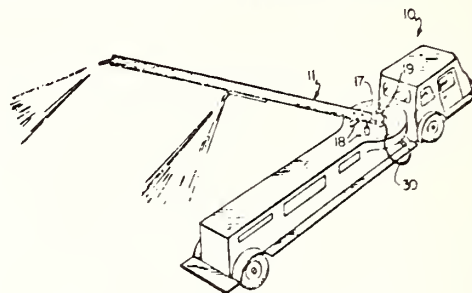


2223. Hux FM and Hudson T

FIRE FIGHTING APPARATUS

US Patent No. 4,007,793; Cl 169/25, (A62C 27/00), Appl 25 Aug 1975, Discl. 15 Feb 1977

Apparatus for fighting fires including a plurality of nozzles mounted on an aerial ladder and supplied with water under pressure which is directed onto the fire is disclosed. Each of the nozzles is controlled from a remote position in a manner such that the direction of the water and the intensity of the water being discharged can be altered as desired. 6 claims, 9 drawing figs. (Author)

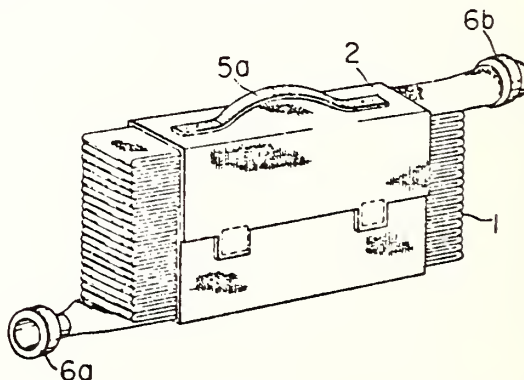


2224. Matsuyama T, Nishida T and Uraya T

PORTABLE FIRE HOSE

US Patent No. 3,942,636; Cl 206/349, Appl 8 Mar 1973, Discl. 9 Mar 1976, Priority: Japan, 30 Mar 1972, 47-38019[U], Assignee: Kanebo Ltd, Japan

Disclosed is a portable fire hose composed of a foldable fire hose and a wrapping sheet member provided with at least one fastening member secured to the wrapping sheet member to tightly wrap the fire hose in its folded condition. The fire hose is provided with a metallic joint composed of a male member rigidly mounted on one end of the fire hose and a female member rigidly mounted on the other end of the fire hose. The fastening member is provided with at least one velvet type fastener. 5 claims, 7 drawing figs. (Author)

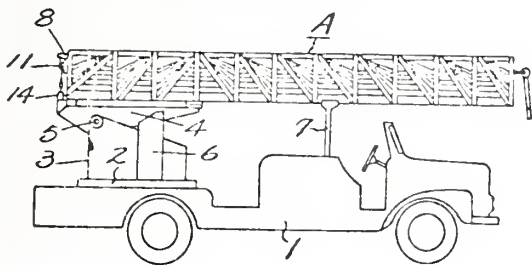


7. FIRE SERVICE ORGANIZATION AND FACILITIES

d. General Equipment—Continued

2225. Terayama F and Nakagawa S
DEVICE FOR PREVENTING JUTTING-OUT OF LADDER TRUCK
US Patent No. 3,980,156; CI 182/66, (E06C 5/06), Appl 25 Aug 1975, Discl. 14 Sep 1976, Assignee: Morita Pump KK, Osaka, Japan

There is provided a device for preventing the jutting-out of the ladder of a ladder truck, wherein when the extending and contracting operation of an extensible ladder is completed and a ladder extending and contracting changeover valve is returned to its neutral position, locking levers are automatically turned to their locking position with respect to several stage ladders required to be prevented from jutting out, thereby providing for prevention of jutting-out, whereas at the time of extension and contraction of the extensible ladder said locking levers are turned to their retracted position to enable the extension and contraction to be effected without hindrance. 2 claims, 4 drawing figs. (Author)



e. INFORMATION SYSTEMS

2226. Abramov M
SEMI-AUTOMATIC ELECTRIFIED REGIONAL FIRE CONTROL MAP
Pozhar delo; (12):26, 1976 (Russian)

A semiautomatic electrified regional fire control map consisting of a control station and a 3.2 x 2.0 m wooden panel with numbers for target facilities and jacks and plugs has been installed at the Angarsk fire control center of the Irkutsk District in Siberia, USSR. The fire-fighting situation is monitored by means of indicator lamps in various colors, symbols, connecting bands, etc. The indicator lamps show the situation in each installation of the system: the fire-extinguishing equipment, operational status, fire hazards, etc. The map also permits the operator to control the fire operations. 1 fig.

f. INVESTIGATION AND REPORTING

2227. Guenther DA, McGarry DL, Shearer RP and MacCleary RC
FIRE ANALYSES FROM MECHANICAL PROPERTIES
Fire Technol; 12(3):173-185, 1976

Often after a severe fire, evidence of a flammable liquid cannot be accurately determined. It is therefore imperative that some additional physical measurement be made on something that is remaining. Pieces of metal are left after a fire. It has been proposed that the tensile properties of the metal would certainly change with extremes of

temperature. If certain limits could be established that would allow predictions to be made regarding the temperature to which a certain piece of metal had been subjected, the fire investigator could make a decision based upon what temperatures could be expected in a normal fire and one that was accelerated. This paper is a preliminary investigation into the feasibility of determining fire causes by analysis of tensile properties of metals. 17 figs, 9 refs. (NFPA)

2228. Bezuglov M
FIRE INVESTIGATION EXPERTISE
Pozhar delo; (10):23-24, 1976 (Russian)

In the USSR all fire incidents are investigated as a matter of law by fire inspectors. In difficult cases experts are called in to assist in the investigation. The order in which expert investigations are carried out and the preceding steps and documents made available to the expert are detailed. It is emphasized that the quality of this investigation depends on the timeliness of calling in the experts. The primary material of the investigation is the fire scene proper. The problems to be solved by the expert are determination of the seat of the fire, its causes, violations of the fire safety regulations, causal connection between the violations, the outbreak of the fire and its development. The roles of the expert and the specialist, who may also be called in by the investigator to add his particular knowledge on some specific point, are not to be confused, since their training and spheres of activity are different.

2229. Berrin ER
INVESTIGATIVE PHOTOGRAPHY. Soc Fire Prot Engrs, Boston, MA; SFPE TR-77-1, 11 pages, 5 figs, 1977
 Availability: SFPE

This article is directed toward arson investigators, fire protection consultants, engineers, metallurgists, or other technical specialists who could use photography as an adjunct to their reports and as a valuable aid in court. Cameras, light meters, electronic flashes, filters, and film suitable for investigative photography are discussed in nontechnical language, as well as techniques such as shutter speed, diaphragm settings, lighting, and composition. Numerous tips are given, along with special requirements of investigative photography, with emphasis on the admissibility of photographs in court. (Author)

g. PERSONAL EQUIPMENT

2230. Burgess WA, Sidor R, Lynch JJ, Buchanan P and Clougherty E
MINIMUM PROTECTION FACTORS FOR RESPIRATORY PROTECTIVE DEVICES FOR FIREFIGHTERS
Am Ind Hyg Assoc J; 38(1):18-23, 1977

Carbon monoxide and oxygen concentrations were measured in 72 structural fires using a personal air sampler carried by working firefighters. In a total sampling time of 1329 minutes the carbon monoxide concentration exceeded 500 ppm approximately 29% of the time. The maximum carbon monoxide concentration was 27,000 ppm, and in 10% of the fires the maximum concentration exceeded 5,500 ppm. Only six runs indicated oxygen concentrations less than 18%. On the basis of these exposure

7. FIRE SERVICE ORGANIZATION AND FACILITIES

g. Personal Equipment—Continued

data, a minimum protective factor of 100 is proposed for breathing apparatus for structural firefighting. 9 figs, 1 table, 4 refs. (Author)

2231. Anon

PROTECTIVE FACE MASKS

Antincendio protez civ; 28(3):191-192, 1976 (Italian)

Protective helmets and masks are important components of a fireman's equipment. Protective masks must meet certain specifications, such as reliable fire protection and good visibility. A special study has been made to select optimal mask characteristics. The prime result was the determination that masks used for similar purposes (eg, in metallurgy) are not suitable for fire extinguishing because they do not protect certain parts of the face reliably. A face sleeve made of rubberized fabric 2 mm thick is recommended to protect the faces of firefighters. This equipment is recommended for extinguishing liquefied-gas, combustible-liquid, vehicle, and other fires. (RZh)

2232. Stoll AM, Munroe LR, Chianta MA, Piergallini JR and Zaccaria DE

FACILITY AND A METHOD FOR EVALUATION OF THERMAL PROTECTION

Aviat, Space and Environ Med; 47(11):1177-1181, 1976

The rationale, construction, operation, and protection assessment methodology of the Naval Air Development Center Fuel Fire Test Facility is described. The background and developmental progress to date are discussed. It is shown that the main difficulties associated with full-scale evaluation of fire-protective clothing have been identified and largely surmounted for present practical purposes. Evaluation can now be made reliably with a reasonably small number of prototypes. Modifications in apparatus and method can be made to provide for other studies. Future effort should be directed toward engineering development of scalar models on the one hand and, on the other, basic research into the depth of burns associated with thermal exposures to radiation and to flame contact. Engineering effort on scalar modeling may greatly reduce the time and cost of obtaining valid burn protection assessments. 17 refs. (Author)

2233. Meyer EC

MEDICAL TESTING OF BREATHING APPARATUS

Draegerheft; (306):23-27, 1976 (German)

The aim of the investigations was to record test data relating to the physiology of breathing in order to prove that there are no objections to the use of the positive-pressure system. A special positive-pressure lung simulator was used for the tests. During the tests the breathing process was simulated with normal pressure, that is, negative inhalation phase, with the prescribed positive pressure, and with an intentionally higher setting of the positive pressure. The lung simulator with the prescribed positive pressure, or protective pressure, did not exhibit any changes in measured values compared to the simulator at normal setting. Anomalous symptoms were detected at the higher positive-pressure setting. 7 figs, 3 refs. (Fachdok 13/0367)

2234. Schlobohm J

TECHNICAL CHARACTERISTICS OF BREATHING APPARATUS USED FOR MEDICAL TESTS

Draegerheft; (306):23-27, 1976 (German)

A technical description is given of the breathing apparatus and lung simulator used to check the suitability of using a positive-pressure system in breathing apparatus. For the medical tests see the article by EC Meyer, "Medical Testing of Breathing Apparatus," in the same issue of *Draegerheft*. 7 figs, 3 refs. (Fachdok 13/0367)

2235. Warncke E

THE POSITIVE-PRESSURE SYSTEM FOR COMPRESSED-AIR BREATHING APPARATUS

Draegerheft; (306):2-15, 1976 (German)

The excess-pressure system for compressed-air breathing apparatus is explained. The starting point is a discussion of the leakage rates of older masks as compared with the much lower rates of contemporary masks. Nevertheless, there are cases of use of breathing apparatus where the positive-pressure system may be advantageous. The system, as it compares with the normal compressed-air apparatus, is described in generally understandable language using graphic displays for both static and dynamic conditions. On the basis of the physiology of respiration it is shown how important it is to reduce the exhalation resistance as fully as possible. A decision tool for choosing an apparatus is given, using computational examples of the types of leakage that are permissible in the case of respiratory toxins. 6 figs, 7 refs. (Fachdok 13/0343)

2236. Varnedoe WW, Jr

DIFFERENT DEVICE FOR SLIDING A ROPE

Fire Eng; 130(3):27-28, 1977

The history of the art of rappelling down a rope as practiced by mountain climbers and spelunkers and as applied to firefighter escape is briefly reviewed. The latest friction device to control descent, a rack (elongated carabiner with brakebars that swing open to opposite sides), and its use are described. 3 figs, 2 photos.

2237. Karpekin VV

COMPLEX ASSESSMENT OF THE EFFECTIVENESS OF PROTECTIVE GAS- AND HEAT-RESISTANT SUITS

Gornospasat delo; (13):34-38, 1976 (Russian)

A method for complex assessment of the effectiveness of protective gas- and heat-resistant clothing is presented, taking into account both the protective features and the constraints on the physical ability of the wearer. Formulas for calculating the absolute complex efficiency index for each suit and for comparative assessment are given. A complex assessment of the effectiveness of any other type of individual protection of human beings may serve as the basis for this method. (RZh)

2238. Gehrman W

FLAMMABILITY REQUIREMENTS FOR PROTECTIVE CLOTHING

Lenzinger Ber; (40):96-101, 1976 (German; English Summary)

7. FIRE SERVICE ORGANIZATION AND FACILITIES

g. Personal Equipment—Continued

Realizing that hazards have become more complex despite or, more precisely, because of technical advances, it is absolutely necessary that suitable protective clothing be developed or improved. The difficulties are that many requirements have to be met simultaneously and that, in addition, the solutions turn out to have contrary effects. On the basis of a compilation of the properties required of such clothing, it is shown that compromises simply cannot be avoided, even though some problems may be solved in the meantime using new materials and techniques. In each case the selection will have to be made in accordance with the use of the protective clothing, especially with regard to type of material and design. (This paper was presented at the 14th International Chemical Fiber Conference held at Dornbirn, Austria, on 24-26 Sep 1975.) 2 tables, 9 refs. (Author)

2239. Leconte R

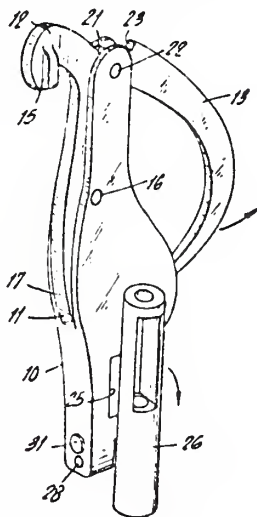
PROXIMITY CLOTHING (A FRENCH EXPORT ITEM)*Rev Tech Feu*; 17(157):38, 40-41, 1976 (French)

Considered are the basic requirements for heat-resistant clothing as a function of the conditions of use. The clothing must protect a firefighter in a fire zone with a temperature of 1200-1400°C. The time the fireman remains under these conditions is determined by the necessity of accomplishing a comparatively simple task, eg, closing a damper or valve. Not more than 60 sec is required for this operation. It was found that it is useless to cover the clothing with an aluminized fabric because a thin aluminum sheet melts rapidly. (RZh)

2240. Ardis AJ

FIREMAN'S COMPOSITE TOOL*US Patent No. 3,949,439*; Cl 7/1G, (B25F 1/04), Appl 18 Jun 1975, Discl. 13 Apr 1976

A combination tool especially suited for firemen, including a number of cooperating elements for efficient operation during a fire, is disclosed. A large hook, normally folded to protect the hook point, and a folding pull handle are the primary components. Other useful elements comprise a spanner wrench for opening and closing hose couplings, and a socket wrench for operating water and

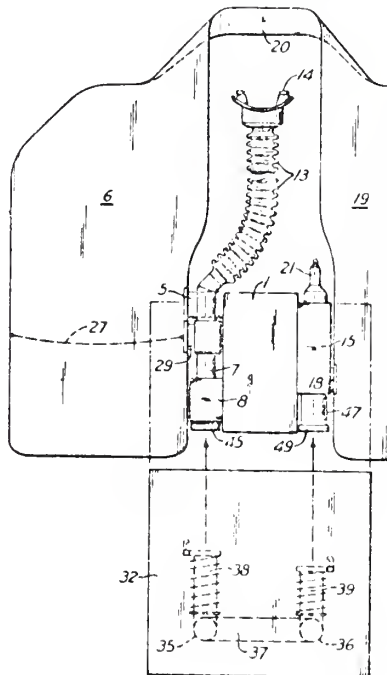


gas valves. The tool is small enough to be carried in a fireman's coat pocket. 8 claims, 8 drawing figs. (Author)

2241. Cotabish HN and Davison EL

SELF-RESCUE BREATHING APPARATUS*US Patent No. 3,980,081*; Cl 128/147, (A62B 7/08), Appl 25 Jun 1975, Discl. 14 Sep 1976, Assignee: Mine Safety Appliance Co, Pittsburgh, PA

A self-contained pendulum breathing main unit includes a first canister containing a bed of oxygen-generating and carbon-dioxide removing chemical, a breathing hose connected with the canister inlet at one side of the bed and a breathing bag connected with an opening to the opposite side of the bed. Tubular connections are associated with the canister inlet and outlet for connecting a supplemental unit thereto. There also is a normally open valve for the inlet. Attachable to the main unit is a supplemental breathing unit provided with a canister containing the same kind of chemical as the first canister. The supplemental unit has a tubular inlet that closes the normally open valve and connects the second canister with the breathing hose when the two units are attached to each other. The second unit also is provided with a tubular outlet that connects the second canister with said opening in the first canister to put the second canister in communication with the breathing bag. 12 claims, 9 drawing figs. (Author)



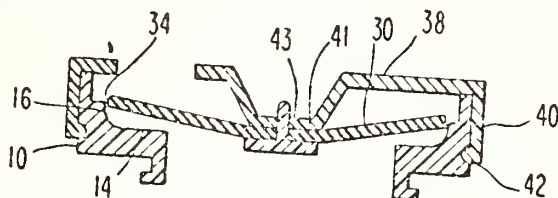
2242. Klinger GS

PROTECTIVE BREATHING APPARATUS AND VALVE THEREFOR*US Patent No. 3,990,439*; Cl 128/142.4, (A62B 18/02), Appl 5 Dec 1974, Discl. 9 Nov 1976, Assignee: ESB Inc, Philadelphia, PA

7. FIRE SERVICE ORGANIZATION AND FACILITIES

g. Personal Equipment—Continued

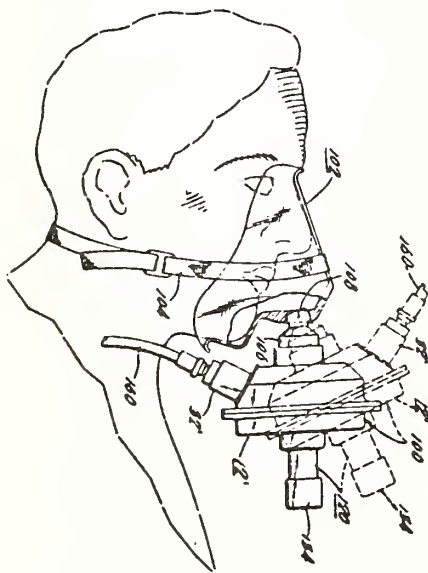
A respirator or gas mask has a check valve having a seat with a raised border. A soft rubber valve is located on the seat and held thereto by a valve retainer. When the valve is not under any pressure, the valve is sealed solely by contact between the rim of the valve and the raised portion of the seat. When back-pressure is placed on the valve, it seats on the entire valve seat area. 7 claims, 7 drawing figs. (Author)



2243. Mills JW, Jr
DEMAND REGULATOR

US Patent No. 3,978,854; CI 128/142.2, (A62B 7/00), Appl 8 Apr 1975, Discl. 7 Sep 1976, Assignee: Lif-O-Gen, Inc, Cambridge, MD

A demand regulator is disclosed for admitting oxygen into emergency breathing systems, resuscitators, and the like comprising a casing supporting a diaphragm and providing a chamber on one side of the diaphragm communicating with the breathing system. The other side of the diaphragm is open to atmospheric pressure. A tilt valve assembly connected to a source of pressurized oxygen opens into the chamber at one side of the diaphragm and includes an elongated tilt valve stem having a free end disposed proximate the center of the diaphragm. The tilt valve is disposed at an acute angle to the diaphragm and is seated by a light cone spring so that only a slight pressure of the diaphragm on the valve stem is required to dislodge the valve from its seat to permit an inflow of oxygen through the valve. For use in a resuscitator,



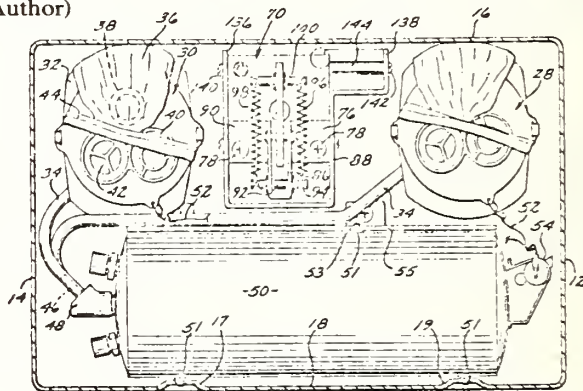
an exhaust check valve and means for normally actuating the tilt valve while closing the check valve are provided. 5 claims, 10 drawing figs. (Author)

2244. Veit HF

EMERGENCY BREATHING MEANS

US Patent No. 3,981,302; CI 128/203, (A62B 7/14), Appl 26 Feb 1975, Discl. 21 Sep 1976, Assignee: Robertshaw Controls Co, Richmond, VA

There is disclosed an emergency breathing supply system that is suitable for use in cabin-pressured aircraft and which is operative upon failure of the cabin pressure. The emergency breathing supply system includes breathing facilities such as breathing face masks and the like stored within a container for retrieval therefrom, a lid attached to the container and secured thereon by a latch mechanism including a latch trigger that is responsive to a preselected value of ambient pressure to operate the latch and release the lid. The ambient pressure sensing device is preferably an aneroid barometer within a sealed housing having a vent port that is opened to the interior of the cabin. The latch mechanism of the container includes a pressure-responsive, latch-triggering subassembly carried on an interior wall of the container and including the sealed housing that contains an aneroid barometer and that supports a hammer bracket, which carries a hammer that is pivotal and spring-biased into an advanced position where the hammer displaces the latch plate of the latch mechanism to release the housing lid. 10 claims, 8 drawing figs. (Author)



2245. Warnow D and Ziebrecht H-J

PNEUMATICALLY CONTROLLED RESPIRATION DEVICE

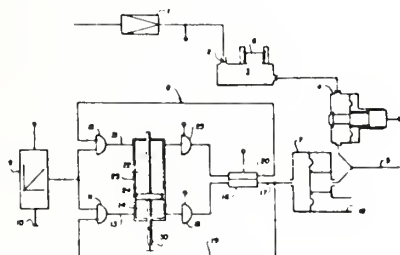
US Patent No. 3,981,301; CI 128/145.8, (A61M 16/00), Appl 26 Jun 1975, Discl. 21 Sep 1976, Priority: FRG, 27 Jun 1974, Appl. No. 2,430,839, Assignee: Draegerwerk AG, FRG

The device is of the type in which breathing gas, taken from a pressure-gas supply source through an injector and volumetrically metered in a pressure regulating valve, is supplied, in the inspiration phase, to the user and discharged, in the expiration phase, through an exhaling valve. A control space is divided by an adjustable partition into an inspiration chamber and an expiration chamber, and the ratio of the volumes of the two chambers is

8. FIRE OPERATIONS: PREVENTION AND SUPPRESSION

g. Personal Equipment—Continued

adjustable by adjustment of the partition. A frequency valve is connected to a source of control gas, and respective first pneumatic control elements connect the chambers, on their upstream sides, to the frequency valve and control supply of control gas to the chambers. Respective second pneumatic control elements connect the downstream sides of the chambers to a bistable storage that is connected to the exhaling valve. The first pneumatic control elements comprise NAND pneumatic elements, and the second pneumatic control elements comprise either identity gates or pairs of NAND elements connected in series with each other. The output sides of the bistable storage are connected to the respective first pneumatic control elements. When the inspiration chamber is filled with control gas, the bistable storage closes the exhaling valve and, when the expiration chamber is filled with control gas, the exhaling valve is opened. 10 claims, 2 drawing figs.



h. PERSONNEL AFFAIRS

2246. Anon
RESPONSE READINESS. A DECISION OF THE ADMINISTRATIVE COURT OF THE FREE HANSA CITY OF BREMEN

Brandschutz; 30(12):315-316, 1976 (German)

The Senator for Internal Affairs of the Hansa City of Bremen (FRG), in a decision dated June 7, 1974, revised the working schedule of the upper ranks of the fire service to 36 hours on duty and 32 hours "on call," one-eighth of which is to be considered working time. The senior fire officials have protested and filed a suit against this decision ("on call" is considered just another name for on duty and impermissible reduction of income); they moved that this decision be revoked. The suit was judged to be justified and suspension of the decision was ordered in the legal opinion. Arguments supporting this ruling are presented in detail. (Fachdok 13/0349)

2247. Prokhorov A
THE STATISTICS SHOW (FIRE APPARATUS ACCIDENTS)

Pozhar delo; (9):24-25, 1976 (Russian)

Analyses of highway accidents involving fire apparatus show that most accidents are due to collisions (47-52% of all accidents). Most of the time they are caused by failure to observe the right of way at controlled and uncontrolled crossings (48-69%). Collisions were also caused by drivers misjudging speeds under dangerous conditions

(20-34%) and failing to observe passing rules (11-20%). Cases of apparatus overturning merit particular attention. These accidents annually account for 33-46% of the number of accidents attributable to the fault of apparatus drivers. Overturning accidents are caused mainly by drivers exceeding speed limits under hazardous conditions (68-84%) and failing to observe passing rules (12-15%). The basic conditions for safe driving are discussed and specific cases of failure to observe the rules are analyzed. 2 figs.

2248. Payne SS
GUIDE TO THE DEVELOPMENT OF WRITTEN JOB-KNOWLEDGE PROMOTION TESTS FOR FIREFIGHTERS. Civ Serv Comm, Personnel Res and Dev Center, Washington, DC; TM-76-16, 69 pages, Dec 1976
Availability: NTIS PB-262 776/8GA

This manual describes a procedure for developing content valid and job-related promotion tests for firefighting personnel in municipal fire departments. It does not advocate the use of such tests; rather it describes one procedure designed to develop such tests if the decision has been made to use them. Although the manual is written for the layman to use and understand, it highly recommends that an appropriately trained psychologist assist in the test development project. (Author)

2249. Payne SS
READING EASE LEVEL OF DC FIRE DEPARTMENT WRITTEN MATERIALS REQUIRED FOR ENTRY-LEVEL JOB PERFORMANCE. Civ Serv Comm, Personnel Res and Dev Center, Washington, DC; TM-76-12, 23 pages, Aug 1976
Availability: NTIS PB-261 704/1GA

This report describes the analysis of the reading ease level of the written materials required for successful entry-level job performance in the District of Columbia Fire Department. The analysis method used is the Flesch Reading Ease Index. The report also offers a modification of the Flesch method for the analysis of the reading level of written texts in the multiple-choice item format. This report is one of several prepared as part of the DCFD Firefighter Selection Examination Project conducted by the DC Fire Department and the Personnel Research and Development Center, Bureau of Policies and Standards, US Civil Service Commission.

8. FIRE OPERATIONS: PREVENTION AND SUPPRESSION

a. COMMUNICATIONS AND SIGNALLING

2250. Kido S
OUTLOOK FOR THE DEVELOPMENT OF COMMUNICATIONS FOR FIRE PROTECTION AND OTHER SERVICES CHARGED WITH HANDLING NATURAL DISASTERS

Denpa Jiho; (2):32-35, 1976 (Japanese)

A survey is made of Japanese achievements in the area of the use of radio communications systems and equipment for fire protection and for other services charged with handling natural disasters, such as floods,

8. FIRE OPERATIONS: PREVENTION AND SUPPRESSION

a. Communications and Signalling—Continued

earthquakes, etc. The effectiveness of the primary radio frequency ranges used for these purposes, namely, 60 MHz, 150 MHz, 400 MHz, and 2 GHz, is assessed. Data characterizing the equipment status of Japanese rescue services in terms of modern radio communication gear are presented. Block diagrams and operating principles of a complex radio-telephone communication system that operates in conjunction with a standard automatic fixed fire-detection and extinguishing system designed for use in highrise buildings and in installations remote from an urban area are given. The functions of the communications system include processing of d-c signals transmitted to the automatic control station from outlying fire detectors, the generation of optical and acoustic alarm signals when the logic circuit decides that a fire has broken out, automatic connection with and dispatch of a call to the municipal fire protection center in two ways simultaneously, by wire over the emergency telephone communication network and by radio using the automatic transmitter that is constantly connected to the control station and transmits a signal via a directional antenna. 2 figs. (RZh)

2251. Voropaev A
RELIABLE RADIO COMMUNICATIONS
Pozhar delo; (12):25, 1976 (Russian)

The effective radius of fixed radio stations is 15-25 km, whereas fire-fighting stations are often from 80-160 km distant from district centers, making it impossible to use the fixed stations for radio communications without supplemental installations. The radio workshop of the Vitebsk (USSR) Fire Protection Division built special 80-W radio sets for installation at all fire control centers, at the Polotsk petroleum refinery, and in some firefighting units. A 54-m tower was also built for a range of 80 km and a 30-m directional antenna for a range of 100 km. A radio-relay system is presently being mounted on a 350-m TV tower to permit communication with all firefighting units.

2252. Kravontka SJ
COMMUNICATIONS FOR FIREFIGHTING AND EVACUATION. Soc Fire Prot Engrs, Boston, MA; SFPE TR-76-5, 11 pages, 5 figs, 9 refs, 1976
Availability: SFPE

The traditional functions of protective signaling are being expanded to include a wide range of audible and visual signaling systems that are being applied to the new demands of the high-density modern building complex. The needs for security protection could complement the fire protection needs. Fire-immune radio-transmission links equivalent to traditional wire links could replace many of the wire links. Audio-visual appliances, television, and film cameras could become standard appliances for protective systems. The superior information conveyance of light over sound, especially for those with hearing impairment, is the basis for visual signaling appliances which could supplement audible appliances. (Author)

b. EXTINGUISHING AGENTS AND ADDITIVES

2253. Anon
EXTINGUISHING FIRES CLEANLY AND QUICKLY WITH LIQUID GAS
Betr Manage Ser; 17(11):102, 104, 1976 (German)

The particular advantages of fire extinguishment using Halon 1211 are reviewed, such as speedy action, suitability for all classes of fires, and harmlessness, with particular emphasis on its nondamaging effects on humans and objects. 3 photos.

2254. Broell R
FLUOROPROTEIN FOAM
Brandschutz; 30(12):325, 1976 (German)

The fluoroprotein foam concentrate Tutogen FP (produced by adding fluorine surfactants to protein foam agents) combines the advantages of protein foam with greatly improved fluidity. The results of VP4 jet fuel fire-extinguishing tests using fluoroprotein foam are reported and compared with data for protein foam: at medium extinguishing rates the times required for extinguishment using fluoroprotein foam were cut in half compared to normal protein foam. Owing to the more rapid extinguishment, as well as its good foam quality, fluoroprotein foam is suitable for use at airports. The expenditure of extinguishant is lower, and therefore the reserve is greater. (Fachdok 13/0350)

2255. Raffalsky K
USE OF DRY POWDERS AND HALONS TO EXTINGUISH FIRES
Brandhilfe; 23(1):270-273, 1976;
23(12):316, 1976 (German)

The extinguishing effect of powders and Halons is based on a different principle from that of water, foam, or CO₂. The effect of the latter is to cool or choke a fire, while the extinguishing effect of the former is due to chemical processes (fire classes B and C). The "inhibiting effect" and the "recombination" principle bring about a reduction and destruction of the radicals required for progress of the chain reaction of the burning process (interaction between the inhomogeneous electrical fields of the dry powder crystals and radicals and interaction of the Halon separation products and radicals). Knowledge of these facts determines the extinguishing tactics. The development of optimal dry powders based on cryolite, bicarbonate, KCl and K₂SO₄; the "barrier layer effect" when extinguishing metal fires; and tests of combinations of dry powder and Halon are also discussed. (Fachdok 13/0298)

2256. Kazakov MV, Sharovarnikov AF, Gorkunenko VM, Karpov VI, Odinets MV and Dyagleva LK
SURFACTANTS — FOAM CONCENTRATES FOR FIRE EXTINGUISHING
Khim prom; (8):613-616, 1976 (Russian)

It is shown that the fire-extinguishing capability of a mechanical foam is a complex function of a number of its parameters. The possibility of using surfactants as foam concentrates for fire extinguishing is evaluated. The parameters that can be used to assess the foam-making capability of foam-concentrate solutions are proposed. The operational qualities of solutions of surfactants are pointed out as factors making them suitable for broad use in fire protection. 4 figs, 1 table, 9 refs. (RZh)

2257. Anon
USING FOAM AS A FIRE-EXTINGUISHING AGENT
K'o Hsueh Shih Yen; (4):158-159, 1976 (Chinese)

8. FIRE OPERATIONS: PREVENTION AND SUPPRESSION

b. Extinguishing Agents and Additives—Continued

Foam concentrates are the primary and most effective fire-extinguishing agent. The organizational and technological problems connected with the production and use of foam materials and some aspects of the mechanism of foam making are considered. The technological process of producing a chemical foam by reacting sulphuric acid with solutions of sodium bicarbonate in the presence of a special foaming agent is described in brief. Also examined are the structure and properties of a mechanical foam consisting of air (90%), water agent (~10%), and foam agent (0.2-0.5%). It is pointed out that mechanical foam is highly effective in extinguishing fires of petroleum products and some solid materials and for preventive protection of objects from ignition by thermal radiation from a nearby fire. The advantage of this foam is that it does not disintegrate for 40 min, which is long enough to suppress a fire in oil and petroleum-product containers. A description is given of a chemical foam generator which works like a water-jet pump. As the water passes through the diffuser, the vacuum chamber becomes rarefied, forcing powder up from the storage container. The mixture of powder and water in the foam pipe changes into foam, which is discharged onto the fire by means of multi-bladed fans. Also described is the design of a foam generator for the production of a high-expansion mechanical foam. 5 figs. (RZh)

2258. Anon

EXTINGUISHANTS FOR SHIP OPERATIONS*New Ships/Neubauten*; 21(7/8):170-171, 1976

The various extinguishants for ship fires are discussed, including water, gas, foam, and dry powder extinguishants, their properties, the classes of fires against which they can be used, etc. The particular properties of the widely used, multi-purpose KOMET EXTRAKT S are described, as are Halons, as replacements for CO₂.

2259. Starokozhev II and Semenov VP

STUDY OF THE EFFECTIVENESS OF EXTINGUISHING COTTON WOOL*Pozhar delo*; (12):24-25, 1976 (Russian)

Special tests were carried out in Tashkent, USSR, to determine the effectiveness and optimal methods of extinguishing fires in bales of cotton with a moisture content of 9.6% and a density of 200 kg/m³; the bales measured 1 x 1 and 2 x 2.4 m. Various extinguishants, including water and wetting agents, were applied by drencher systems. The test conditions and experimental results are compiled in a table. The extinguishing efficiency was measured in terms of the specific quantity of extinguishant required to extinguish the fire in 10 min. The wetting agents "Nekal" (a surfactant) and "PO-1A" (a mixture of sodium alkylsulfates) were found to be more effective than water and a 0.07% solution of polyacrylamide. 2 figs. (See also a similar article by the same authors in *Khlopk Prom* in this issue of *FTA*.)

2260. Morikawa T

A NEW SODIUM-CARBONATE-BASED EXTINGUISHANT FOR SODIUM FIRES*Rep Fire Res Inst Japan*; (42):2-10, 1976 (English)

A large number of tests has shown that sodium carbonate alone cannot be used as a basis for a new extin-

guishant because of its susceptibility to pick up moisture and its specific gravity. But mixtures with 6% polyacrylonitrile (PAN) and 4% of either polyethylene (PE), polystyrene, or Mg-stearate have proved to be reliable extinguishants for sodium fires. The apparent effect of these additives is to make the mixture more flexible and fluid, whereas it seems to be inhibited by a binder without these additives. In practice PAN and PE should be used as the principal additives, the Mg-stearate as a secondary additive. 3 figs, 3 tables, 6 refs. (Fachdok 13/0398)

2261. Broell R

MECHANICAL FOAM EXTINGUISHANTS*VFDB Z*; 26(1):30-33, 1977 (German)

In this second part of a two-part review article on foam extinguishants (for part 1 see *FTA*, 1(5), abstract 1811) the author continues with a description of foam properties, such as adhesion, yield, stability, and extinguishing effects. The influence of the proportion of foam compound on foam quality, particularly yield and stability, is discussed, as are the working pressure at the foam nozzle, external effects (water and smoke gas) on foam generation, physical data of foam compounds (pH, sediment, precipitate, viscosity, pour point and surface tension), quality control of compounds, and storage. 9 refs.

2262. Corrie JG

EXPERIMENTAL METHODS FOR THE STUDY OF FIRE-FIGHTING FOAMS. *Fire Res Sta (UK)*; BRE CP-74-76, 10 pages, 14 figs, 25 refs, Dec 1976

Described in this paper are studies on the use of foam in the extinction of flammable liquid fires and experimental techniques which can be used to evaluate its performance. These include four methods for producing foam in the laboratory and methods for measuring the expansion, drainage rate, and shear stress of the foam produced. Areas in which further knowledge of foam performance are required are suggested, and 24 references are given. (Author)

c. HYDRAULICS AND WATER SUPPLIES

2263. Myrick CR

EQUITABLE PUBLIC AND PRIVATE FIRE-PROTECTION CHARGES*Am Water Works Assoc J*; 68(4):185-188, 1976

To be prepared to meet the water demand caused by large fires requires a large capital investment by the water utility, as does bearing the maintenance and operating costs of providing this service. Although there is not complete agreement among authorities as to the best method, this article presents several methods that may be used in allocating public and private fire-protection costs. (Author)

2264. Thompson WJ

FIRE HYDRANT*US Patent No. 3,939,861*; Cl 137/299, (E03B 9/04), Appl 19 Jul 1974, Discl. 24 Feb 1976

A fire hydrant designed to prevent the unauthorized use of an outlet nozzle that is located on the above-ground barrel portion of the standpipe is disclosed. The

8. FIRE OPERATIONS: PREVENTION AND SUPPRESSION

c. Hydraulics and Water Supplies—Continued

hydrant includes a valve means located within the barrel portion and provided with a valve member that is biased to a closed position extending across the upstream end of the outlet nozzle. A valve actuator is provided to be threaded onto the outlet nozzle for moving the valve member away from the closed position to an open position, permitting the flow of water through the outlet nozzle. 7 claims, 8 drawing figs. (Author)

2265. Franceschi PA

TAMPER-PROOF LOCKING SYSTEM FOR FIRE HYDRANTS

US Patent No. 3,935,877; CI 137/296, (F16K 35/06), Appl 23 Jul 1974, Discl. 3 Feb 1976

Disclosed is a tamper-proof locking system for a standard fire hydrant, one embodiment of which includes a cap assembly that fits over the valve stem of the hydrant and is fastened thereto. The cap assembly cannot be turned to open the valve except by means of a special wrench that is adjustable to securely grip the assembly. In another embodiment, the system includes a cover assembly that replaces a standard hydrant port cover and cannot be taken off the nipple of the port except by the special wrench. 8 claims, 9 drawing figs. (Author)

d. INSPECTION

2266. Nielsen R

DUAL RESPONSIBILITIES RESULT IN DOUBLE BENEFITS

Fire Command; 44(4):24-25, 1977

Assigning responsibility for building permits and inspections to the fire department may give a municipality two tangible results: 1) the measurable productivity of the fire department is improved and 2) costs to the taxpayers are lowered. If the program is well organized and enthusiastically conducted, increased fire safety is likely to be the greatest benefit. The experience of the Oak Brook, Illinois, Fire Department is presented.

2267. Miller DM

A COMPUTERIZED PLANNING SYSTEM FOR BUREAU INSPECTORS

Fire Technol; 12(3):237-246, 1976

A computerized system, developed for the Atlanta Fire Prevention Bureau to help use its full-time inspectors in the most effective and efficient manner, is described. The system is concerned with how often to conduct routine planned inspections in all public and commercial buildings in the city, how to set up territorial responsibility for each inspector, and when to conduct each routine, planned inspection. Man-hours available for inspections can be more effectively used, and there is a potential for reduction in the number of supervisors. By better balanced districts, there will be more equality in work loads, leading to better morale. More compact inspection districts permit reduction of travel time. 3 figs, 1 table, 1 ref. (NFPA)

e. OPERATIONAL PROBLEMS

2268. Anon

THE NFPA ORGANIZED THE FIRST INTERNATIONAL SEMINAR ON AIRCRAFT RESCUE AND FIREFIGHTING IN GENEVA

Air Cosmos; 14(638):31, 48, 1976 (French)

The "Aircraft Rescue and Firefighting" section of the National Fire Protection Association held an extended colloquium devoted to aircraft design, airports and airport installations, and control of rescue and firefighting operations in Geneva in September 1976. The colloquium is criticized for the length of the papers read in the restricted time allotted (14 in 20 hours), for the emphasis placed upon fire extinguishment rather than fire prevention, and for the lack of attention devoted to problems involving the aircraft proper. 2 photos.

2269. Cleary MJ and Whippen JA

CRISIS MANAGEMENT IN THE FIRE SERVICE

Fire Chief; 21(4):62-64, 1977

Firefighting presents an environment in which perfect decision making is impossible. In this article a closer look is taken at that environment in order to examine possible methods to better prepare individuals for "crisis decision making" situations. The influences affecting the ability to make better decisions are identified as the experience level, the tactical ability of the officer, and pre-fire planning. A systems analysis approach to decision making is outlined in a flow chart. 1 fig.

2270. Etienne fnu

MALICIOUS FALSE ALARMS: HOW CAN THEY BE REMEDIED?

Rev Tech Feu; 17(158):53-55, 1976 (French)

In 1964 there were 2,143 false alarms in Paris and three Departments; in 1974 this figure had increased to 5,984. The trend toward an increase in false alarms has also been noted in other cities. Responses to false alarms represent an appreciable economic loss (expenditure of fuel and lubricants), lead to increased wear of the firefighting equipment, especially vehicle tires, result in congested traffic, and cause the personnel of the fire-protection units to become edgy. In Belgium a fire communications center has been set up in which it is technically feasible to find out in 5 sec the number of the telephone or telephone booth from which a call has been made and its location. If the caller does not give the correct number of the telephone or if the place from which the call was made is located a considerable distance away from the address of the call, the call can be considered false. The operator at the center can arrange for commutation with the set from which the call is coming. The conversation with the caller is recorded on a tape recorder with automatic recording of the time of the call. The perpetrator can be arrested by the police on the spot. Legislative bodies are considering fines and imprisonment as a punishment. 3 figs. (RZh)

f. PUBLIC EDUCATION AND PUBLIC RELATIONS

2271. Rasbash DJ

THOSE FIRE DISASTERS

Med Leg J; 44(3):71-84, 1976

8. FIRE OPERATIONS: PREVENTION AND SUPPRESSION

f. Public Education and Public Relations—Continued

In an address presented to members of the Medico-Legal Society meeting in London in February, 1976, the head of the Department of Fire Safety Engineering of the University of Edinburgh reviewed in considerable detail (illustrated by slides) a number of modern fires of disaster proportion in various kinds of premises to illustrate the problems involved in modern fire safety engineering and to inform the audience of causes and remedies for these disasters. Lessons to be derived from an analysis of these fires and how these lessons are to be applied to disaster prevention were brought out in the course of the address.

2272. Friedag H, Pabst S and Geisler K
PUBLIC RELATIONS

VFDB Z; 26(1):5-9, 1977 (German)

Three addresses on the public relations topic, one by each of the authors, were presented at the public sessions of the Professional Fire Department Committee of the Association for the Advancement of Fire Protection in Germany (VFDB) during its 1976 annual professional meeting in Berlin. Various viewpoints were expressed, ranging from the absolutely positive impression implanted in the public by every fire response, in the opinion of Friedag, especially when compared with police actions, to Pabst's criticism of the fire departments' operations in the wildfire disaster in the Lueneburger Heide in 1975, as expressed by the media, which gave too little credit to the unstinted efforts of individuals, to the report of a press representative concerning his positive cooperation with the Berlin Fire Department (Geisler). Even negative events will be understood by the public if presented in the right light. (Fachdok 13/0436)

g. RESCUE OPERATIONS

2273. McRae M
FIRE DEPARTMENT OPERATIONS WITH MODERN ELEVATORS

Robert J Brady Co, Bowie, MD; 128 pages, 1977

This manual is written specifically for firefighters to help them deal with the special hazards posed by modern elevators and burning buildings. The organization of the book follows a logical sequence. First the author discusses the history of the elevator, then construction and operation of modern elevator installations. Building upon this knowledge of structure and function, the manual details three categories of elevator emergencies that confront the firefighter: the problem of elevator use by firefighters under fireground conditions; the task of rescuing trapped persons; and the fire potential in elevator installations themselves. For each area, procedures and alternatives are presented. A total of 40 illustrations help to clarify the written descriptions and instructions.

2274. Chicarello PJ and Shpilberg DC
MINIMUM EXTINGUISHMENT AREA REQUIRED FOR SAFE ESCAPE OF AIRCRAFT OCCUPANTS DURING A FUEL SPILL FIRE

Fire Technol; 12(4):276-289, 1976

The minimum area of an aircraft fuel spill fire that must be extinguished and secured to retard fuselage melting and provide a fire-free route for sufficient time to

allow the plane's occupants to escape was determined analytically. In the case of a severe spill fire, equipment response time of 60 seconds or less is required for a reasonable chance of rescue of the occupants of an aircraft. Flame contact with the fuselage must be terminated quickly, and the flame front must be moved back sufficiently to cause a significant delay in burn-through. A separation distance of only 5 ft will cause an important delay in burn-through, provided the fire is extinguished in time. 7 figs, 7 refs. (NFPA)

2275. Jin T
VISIBILITY THROUGH FIRE SMOKE. PART V: ALLOWABLE SMOKE DENSITY FOR ESCAPE FROM FIRE

Rep Fire Res Inst Japan; (42):11-18, 1976 (English)

A description is given of investigations aimed at determining the smoke density level that can be allowed when the evacuation of burning buildings is not seriously threatened. In these tests, which were carried out under various conditions, it was found that the measured walking speeds were in approximate agreement with the values established as a minimum requirement. The allowable smoke density also depends on whether the building occupants are familiar with the local situation, on how they are irritated by smoke under other conditions, and on whether there are objects along the escape routes that represent an appreciable impediment to escape. 6 figs, 3 tables, 12 refs. (Fachdok 13/0422)

2276. John R
SCIENTISTS AGAINST FIRE FATALITIES — THE FIRE PROTECTION ENGINEERING RESEARCH CENTER IS STUDYING ESCAPE ROUTES IN BUILDINGS
Uni-Inf Karlsruhe; (1):10-11, 1977 (German)

Escape routes are an important factor for life safety in buildings. The greater the number of people in a building, the greater the care that must be exercised in designing escape routes. In order to provide correct instructions for dimensions in planning buildings, the characteristics of the movement of flows of people in vestibules and on stairs must be known. With the goal of permitting exact preliminary calculations to be made of the times required to evacuate various kinds of buildings, the Fire Protection Engineering Research Center of the University of Karlsruhe (FRG), in collaboration with the professional fire departments of the cities of Cologne, Duesseldorf and Hamburg, carried out six evacuation tests in highrise administrative buildings in October, 1976. A report is made on the test methods. 3 figs. (Fachdok 13/0395)

2277. Dalhoff W, Knippertz HJ and Timmerberg CH
EMERGENCY GUIDANCE SYSTEMS FOR THE EVACUATION OF PEOPLE FROM BUILDINGS IN CASE OF DANGER

VFDB Z; 26(1):37-40, 1977 (German)

Following a brief description of the unsatisfactory status of life safety protection in buildings, the topic of development of new kinds of safety devices, in particular emergency guidance systems, is introduced. These systems are designed to aid people to escape from endangered buildings, under panic conditions, regardless of their level of education, language or sophistication. But an important

8. FIRE OPERATIONS: PREVENTION AND SUPPRESSION

g. Rescue Operations—Continued

prerequisite for a safety-oriented development of such systems is an understanding of human behavior in fires and disasters. This psychological problem is the theme of this first part of a two-part article on emergency guidance systems. The psychology of panic is discussed as an introduction to the problem of human behavior in fires and disasters, which is considered in terms of factors affecting behavior and behavior observed in actual fires. The psychological experience underpins the need for guidance systems, the parameters of which are derived. The design, structure, and operating principles of the newly developed systems are outlined.

2278. Pieper H

EVACUATION BY MEANS OF THE RESCUE CHUTE

ZS Magazin; (12):26-27, 1976 (German)

Only a few manipulations are required to ready a rescue chute which was recently introduced to the public by a Hamburg (FRG) manufacturer. Within one minute 20 people can be evacuated from second and third stories via the chute, which can be used up to a height of ten meters. This rescue system is suitable primarily for public buildings such as youth hostels, boys homes, hospitals, and old-peoples' homes. The merits of the device are ease of handling, high capacity, and weather resistance. 5 figs. (Fachdok 13/0295)

2279. Booth F

FIRE ESCAPE

US Patent No. 3,982,608; Cl 182/49, (E06C 9/10), Appl 9 Jun 1975, Discl. 28 Sep 1976, Assignee: Booth Fire Escape Ltd, New Westminster, Canada

Disclosed is a fire escape apparatus having a flight of stairs formed of a smooth material having treads and risers and which is mounted beneath a balcony for swinging movement between a horizontal position and a downwardly inclined position, the treads and risers being

so shaped that when the flight of stairs is in the inclined position, the treads slope inwardly and downwardly and the risers curve outwardly and downwardly to the treads so as to facilitate descent in a sitting position and to enable the stairs to be climbed in a normal manner. 4 claims, 5 drawing figs. (Author)

2280. Campbell WM

FIRE ESCAPE

US Patent No. 3,980,155; Cl 182/49, (A62B 1/20), Appl 24 Jun 1974, Discl. 14 Sep 1976

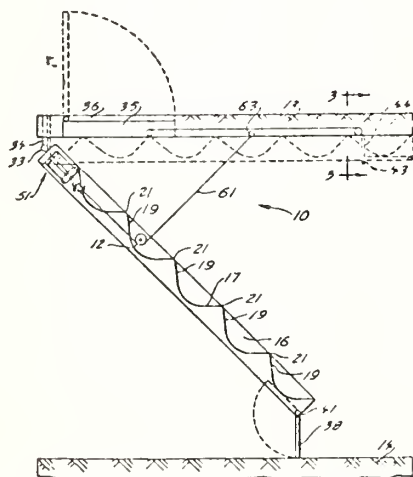
A fire escape is patented for use in multi-storied buildings having floors spaced generally equally from adjacent floors at floor spacing. The fire escape has a fire-resistant, vertical, hollow outer column and a similar inner column positioned generally centrally within the outer column. The outer and inner columns have a generally oval-sectioned inner and outer wall, respectively, spaced apart to provide columnar space therebetween. A chute within the columnar space follows a generally helical path of essentially constant pitch of twice the floor spacing so that one complete circuit of the chute passes two floors. In one embodiment for wide floor spacing, the inner column is hollow and has column floors disposed therein level with floors outside the outer column and a spiral stairway spaced above the chute to follow the chute with sufficient head room for persons on the chute or stairway. A person escaping enters the outer column through a door opening and can descend the stairs directly, or through openings in the inner column can descend by the chute. In a second embodiment for narrower floor spacing, a columnar space contains the chute and stairway arranged side-by-side having equal helical pitches, the stairway spaced outwards from the chute. A dividing wall between the chute and stairway prevents interference between persons using the chute or stairway. An opening through the outer column permits access to the stairs, and an opening through the dividing wall permits access to the chute. In both embodiments a second complementary chute and stairway can be provided so that each embodiment has four independent escape routes. 11 claims, 9 drawing figs. (Author)

2281. Jimenez R

PORTABLE WINDOW-ATTACHED EMERGENCY DESCENT MECHANISM

US Patent No. 3,978,942; Cl 182/75, (A62B 1/08), Appl 17 Apr 1975, Discl. 7 Sep 1976

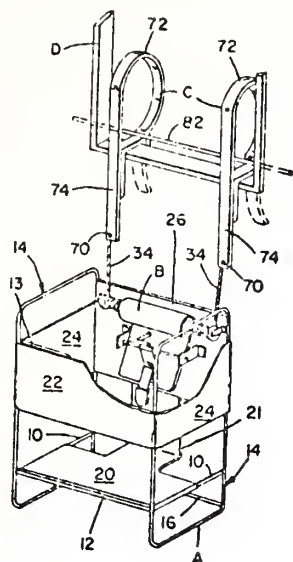
A portable descent mechanism is disclosed that allows the use of a conventional window as an avenue of escape in emergency situations such as fires and comprises a passenger chair, spools with cable wound thereon, a brake, and window attachment apparatus designed for simple engagement with a conventional windowsill and utilizes a pair of hooks that fit over the windowsill. 5 claims, 5 drawing figs. (Author)



FIRE TECHNOLOGY ABSTRACTS

8. FIRE OPERATIONS: PREVENTION AND SUPPRESSION

g. Rescue Operations—Continued



2282. Murukurthy RK
LADDERLESS SAFETY ESCAPE DEVICE
US Patent No. 4,026,385; Cl 182/75, (A62B 1/10), Appl 19 Jan 1976, Discl. 31 May 1977

A ladderless safety escape device includes a cable drum upon which a cable is wound having means secured to the free end thereof for the support of a person. A braking mechanism is operatively connected to the cable drum for controlling the rate of descent of the person. A brake

control mechanism is provided for operatively disconnecting the brake mechanism from the cable drum during re-winding of the cable and insures operative connection of the brake mechanism and cable drum during unwinding of the cable. 4 claims, 3 drawing figs. (Author)

2283. Kravontka SJ
ELEVATOR USE DURING FIRES IN MEGASTRUCTURES. Soc Fire Prot Engrs, Boston, MA; SFPE TR-76-1, 8 pages, 9 refs, 1976
 Availability: SFPE

With the possible advent of "megastructures" (very high multiple-use towers), which could be considered as a number of buildings (100 ft cubes) within one large building, the problem of fire safety will be intensified. Occupant safety during fire emergencies would involve movement from fire-alarmed areas to fire-safe areas by redesigned elevator equipment that would be operationally safe for the time required for occupant movement during the fire. Of course, passage of elevators through the fire area would not be contemplated. Future traction machines would be characterized by miniaturization and encapsulation. Controlled rectifiers with associated silicon-based, solid-state circuitry would replace the conventional motor-generator sets with associated starters on traction machines. Solid-state circuitry would be preferred to conventional relay circuitry for car control and dispatch. Cab design should involve consideration of the effects of metal exposure to relatively short periods at elevated temperatures. The paper provides some innovative ideas on the solution of this difficult problem based on a total systems approach.

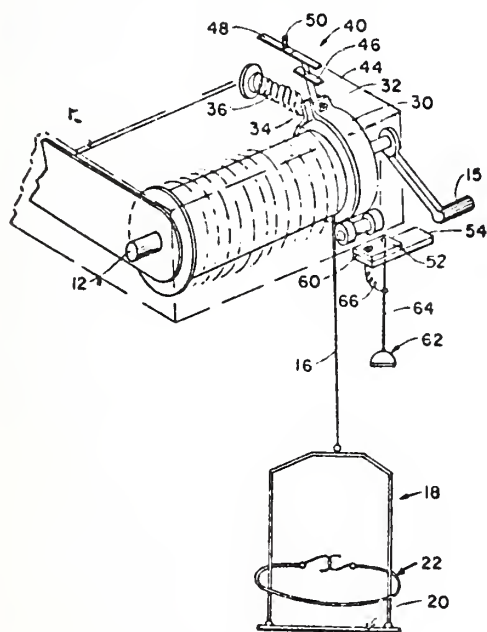
h. TACTICS

2284. Nash P
FIRE-FIGHTING AND RESCUE TECHNIQUES AND EQUIPMENT
World Airports Conf, 5th, Proc; 1976, May 5-7, Brighton, England, pages 21/1-21/8

Part 1 of the paper deals primarily with the development of fire extinguishing materials to deal with the high potential fire risks presented by modern aircraft. The aim is to achieve major control of the fire within a very short time in order to effect rescue. The advantages and disadvantages of water-based foams, dry powders, inhibiting liquids or gases and water sprays are discussed. In Part 2 the practical aspects are dealt with, particularly in relation to the recommendations of the International Civil Aviation Organization. Both parts of the paper emphasize that speed and efficient deployment of staff and equipment are essential, and that airports must have emergency plans for instant implementation. (Author)

2285. Kerr JW
PREPLANNING FOR A NUCLEAR INCIDENT
Fire Command; 44(4):18-20, 1977

Preplanning for nuclear incidents, which are most frequently handled by the fire department, is different from planning for a fire in a specific building, in that



8. FIRE OPERATIONS: PREVENTION AND SUPPRESSION

h. Tactics—Continued

the planning must be done without regard to location or structure, particularly when transport is involved. Regardless of the size of the incident, the basic rules are: 1) to notify the proper authorities; 2) to identify the hazards; 3) to find the limits of the area involved; and 4) to reduce the risk of exposure to people. It is emphasized that operations are generally similar to those for ordinary fires, except that rescue requires extra speed and that radiation hazards require fast approach and exit. Training and prevention are described. A sample calculation of dose rates and firefighter exposure time is given. The radiation characteristics of common isotopes are compiled in a table. 1 fig, 1 table, 4 refs.

2286. Takita M, Sirako N and Kita H
FIRE FIGHTING IN RAILWAY TUNNELS
Kasai; 26(2):73-84, 1976 (Japanese)

Statistical data characterizing various fires that took place in railway trains in Japan from 1962 through 1974 are presented. The fires are classified in detail by a number of features, the main ones being as follows: time and place of outbreak of the fire; type of train and car in which the fire occurred; speed at the time the fire broke out and while it was being extinguished; meteorological and atmospheric conditions at the time the fire broke out; causes and circumstances of the fire; means used to extinguish the fire; duration; number of casualties; and magnitude of the material loss. The sequence and nature of the actions taken to fight the fires are analyzed. A block diagram of an optimal fire suppression process in the case of a moving train is presented. An analysis is made of the specific features of outbreak, spread and suppression of fires in railway trains in tunnels. The structure of several of the most widely found railway tunnels in Japan is discussed from the viewpoint of fire safety. The design, parameters, and operating principle of a complex automatic fire extinguishing system for a Ryokoku railway tunnel that is more than 13 km in length are described. The system is equipped with a set of TV cameras to provide visual supervision of the situation. 9 figs, 9 tables, 9 refs. (RZh)

2287. Naylor D
THE EFFECT OF FIRE ON CONTAINERS
Safety Sea Internat; (89):12, 1976

The two effects considered briefly in this article are the effects of fires that begin inside containers and those that begin outside them, the containers being differentiated with regard to whether they are closed or open. Considered in particular are closed containers, since open containers have little or no effect on the flammability. Methods of fighting fires in containers are outlined.

9. PLANNING

a. BUDGETING

2288. Kasmekat W
FIRE DEPARTMENT — COMMERCIAL VENTURE OR HUMANITARIAN ORGANIZATION? SOME THOUGHTS ON EFFICIENCY STUDIES IN THE AREA OF PROFESSIONAL FIRE DEPARTMENTS
Brandschutz; 30(12):313-314, 1976 (German)

The practice of increasing the cost-benefit ratio of an organization on the basis of statistical evaluations can lead to disastrous situations when applied to the professional fire department. A major fire can also break out, valuable property can be destroyed, and human lives can be endangered at times not within the statistically determined peak periods of the day. The author questions whether theoreticians who want to reorganize a fire department along economic lines are also willing to bear the responsibility for an unsuccessful response and the sacrifice of human lives. A cost-benefit analysis weakens the striking power of the fire department. (Fachdok 13/0325)

2289. Baldwin TF, Wirth MO and Yadon RE
PREFIRE PLANNING COST ANALYSIS: A CASE STUDY
Fire Chief; 21(4):65-70, 1977

Prefire planning provides much of the information necessary to fight fires safely and efficiently. The net social benefits to be derived therefrom would appear to be positive if the costs are reasonable, eg, if fire department personnel can conduct prefire planning as a collateral duty. This method was the one selected for evaluation of the feasibility of prefire planning with the goal of short-term completion at the Rockford, Illinois, Fire Department. An estimate was obtained of the number of buildings involved and the amount of time necessary to conduct a prefire plan. Still to be identified are the most cost-effective methods of prefire plan training. Tables identify buildings by size and type, time allocation per activity and building size, projected costs per activity and building size, minimum costs for full-time prefire specialists, and cost-effectiveness ratios for alternate methods of prefire plan staffing. 5 tables.

b. LOGISTICS

2290. Corman H, Ignall EJ, Rider KL and Stevenson A
FIRE CASUALTIES AND THEIR RELATION TO FIRE COMPANY RESPONSE DISTANCE AND DEMOGRAPHIC FACTORS
Fire Technol; 12(3):193-203, 1976

Fatalities and injuries per structural fire in New York City have been compared by time of day, season, year, construction, region of the city, floor of origin, and occupancy. The number of casualties per structural fire has not been on the increase, but there are significant time of day and seasonal effects on life hazards that should be considered in providing fire protection services. A study of the relationship between response distance and fire casualties indicated a significant correlation, but one which was overwhelmed by many other factors and could not be used as a primary criterion in developing mathematical fire resource allocation models. 1 fig, 12 tables, 3 refs. (NFPA)

c. OPERATIONS ANALYSIS

2291. Walsh CV
HOW VALUABLE ARE YOUR PREFIRE PLANS?
Fire Command; 44(3):24-25, 1977

Prefire planning is limited by the fact that it must be based only on static factors. The effects of dynamic fac-

FIRE TECHNOLOGY ABSTRACTS

10. HUMAN BEHAVIOR, SOCIAL, AND MEDICAL PROBLEMS

c. Operations Analysis—Continued

tors can make it difficult, if not impossible, to implement as intended some decisions made during prefire planning. The most important prefire planning consists of training fire officers to recognize and deal with the highly variable conditions that they may encounter. The possibilities of applying operations research to the problem, that is, the application of scientific methods to the study of alternatives, are mentioned.

10. HUMAN BEHAVIOR, SOCIAL, AND MEDICAL PROBLEMS

[For more complete coverage of the behavioral and medical literature see: **Psychology Abstracts** and **Index Medicus**.]

a. ARSON

2292. Suchy JT (Ed)

ARSON: AMERICA'S MALIGNANT CRIME

National Fire Prevention and Control Administration, Washington, DC, 34 pages, 1976

This booklet presents the results of two "Leadership Seminars for Developing a Coordinated Attack on Arson" organized by the National Fire Academy in January and February, 1976, in which 36 experts on arson (listed in Appendix C) from throughout the nation identified nine needs areas and recommended a number of specific courses of action for both public and private agencies and private industry. As a direct result, the National Fire Academy is preparing courses in arson detection and investigation, and the National Fire Data Center is establishing an arson information center as part of the National Fire Reference System. The needs identified by the participants are: to develop and define responsibilities; to reclassify arson in crime reporting systems; to develop and improve public awareness; to develop and apply training programs keyed to job-related requirements; to develop and apply better reporting, data collection, and data analysis; to promulgate and apply effective laws and regulations (it is recommended to reclassify arson as a Part-One crime); to identify and develop sources of funding; to conduct research and development; and to develop a consistent, uniform terminology. (This booklet is available from the NFPCA.)

2293. Sluga W

FIRESETTING AND THE FIRE DEPARTMENT

Brandaus; 84(12):485-488, 1976 (German)

Firesetters are people with an abnormal psychological makeup. Childishness, low intelligence, bedwetting, alienation, and incapability of coping with life are some of the features common to firesetters which produce aggression. In the history of mankind firesetting is one of the earliest forms of acting out aggressions. Brain damage in early childhood and early unfavorable developmental conditions can lead to the features mentioned above. Scientific knowledge of firesetting should be considered in suitability and hiring of investigators in the fire department. (Fachdok 13/0321)

2294. Wise MK, Jackson D and Maguire HM

WHAT THREE CITIES ARE DOING IN THE FIGHT AGAINST ARSON

Fire Chief; 21(4):53-57, 1977

The arson squad of the Denver, Colorado Fire Department, the police detective/fire lieutenant arson investigation teams of the Calgary, Canada, Fire Department, and the arson investigation training program for western Washington's fire departments based on Seattle's Arson Task Force program and their successes in combatting arson are described.

2295. Provencher RG

ARSON '76. INS Investigations Bureau Inc, New York; SFPE TR-76-3, 7 pages, 1976

Availability: SFPE

Arson represents a dollar loss four to eight times greater than any other individual crime. Only in cases where there are deaths does arson concern the public. Arson investigation is frustrating, difficult, time-consuming, dangerous, and often fruitless. In the majority of cases of arson, the victim or alleged victim can frequently provide both the motive and the suspect. Arson is a very personal thing and the victim may be closely associated with the crime and the perpetrators. The control is based on thorough investigation before the insurance is written, aggressive investigation after the fire, and a no-compromise defense in the denial of the claim before the civil court. Thorough investigations act as a deterrent to other arsonists. (Author)

2296. Borg N and David L

ARSON: A MULTI-DIMENSIONAL PROBLEM. Soc Fire Prot Engrs, Boston, MA; SFPE TR-76-4, 5 pages, 1976

Availability: SFPE

Arson is the fastest growing and one of the most costly crimes in the United States. A large segment of profit-motivated arson can be controlled by tactically reducing the motivation by removing the dollar incentives. A more selective method of writing insurance and a tougher policy of settling claims is indicated. Neighborhood preservation is essential to arson reduction. Vacant buildings must be demolished or sealed. Arson is a symptom of many social phenomena such as poverty, a deteriorating housing infrastructure, a poor investment climate, and an antiquated welfare system. Solution to these social ills must come from the federal government, although this is unlikely in the foreseeable future. The constraints of the legal environment on public policy alternatives *vis-a-vis* arson must be altered to favor law-abiding tenants, landlords, and businessmen at the expense of profit-oriented arsonists. (Author)

b. COMBUSTION TOXICOLOGY

2297. Anon

PHYSIOLOGICAL AND TOXICOLOGICAL ASPECTS OF COMBUSTION PRODUCTS

Nat Acad Sci Printing and Publ Office, Washington, DC; 255 pages, 1976

Explored in this book from the Committee on Fire Research of the National Research Council are the effects of combustion products on the human body. The 18

10. HUMAN BEHAVIOR, SOCIAL, AND MEDICAL PROBLEMS

b. Combustion Toxicology—Continued

presentations comprising the volume center on four major subject areas: smoke problems arising during fires, smoke and fire casualties, physiological and toxicological aspects of fire exposure, and the development and characterization of smoke. The material is taken from papers presented at an international symposium held in March 1974. The authors are experts in fields such as environmental medicine, toxicology, surgery, and flammability research, and include representatives of fire departments, government, educational institutions, and industry.

2298. Hilado CJ and Lopez MT

RELATIVE TOXICITY OF PYROLYSIS PRODUCTS OF SOME ELASTOMERS

J Combust Toxicol; 4(1):61-68, 1977

Ten samples comprising seven generic types of elastomers were evaluated for relative toxicity using the USF/NASA toxicity screening test method. The nitrile rubber samples appeared to generally exhibit greater toxicity than the samples of polyisoprene, styrene butadiene, and chlorinated polyethylene rubber. Carbon monoxide was present in sufficient concentration in the blood of the test animals to be the principal cause of death in the case of polyisoprene and styrene butadiene rubber. 6 tables, 4 refs. (Author)

2299. Hilado CJ, Marcussen WH, Furst H, Kourtides DA, Parker JA and Fewell LL

RELATIVE TOXICITY OF PYROLYSIS PRODUCTS OF SOME AIRCRAFT SEAT MATERIALS

J Combust Toxicol; 4(1):16-20, 1977

Eighteen samples of aircraft seat materials were evaluated for relative toxicity using the USF/NASA toxicity screening test method. Nine samples were upholstery fabrics and nine samples were cushioning foams. Under these particular conditions of test, the aromatic phenolic and aromatic polyamide fabrics exhibited less toxicity than the samples of wool and wool/nylon fabrics, and the samples of neoprene foams exhibited less toxicity than the samples of polyurethane foams. These relative toxicity rankings were obtained using both apparent lethal concentration for 50 percent of the test animals (ALC₅₀), and time to death (Td) at a fixed weight of material. 2 tables, 2 refs. (Author)

2300. Hilado CJ and Crane CR

COMPARISON OF RESULTS WITH THE USF/NASA AND FAA/CAMI TOXICITY SCREENING TEST METHODS

J Combust Toxicol; 4(1):56-60, 1977

Samples of nine materials were evaluated using the USF/NASA and FAA/CAMI toxicity screening test methods. The materials were wool, modacrylic/rayon, polysulfone, polychloroprene, polyvinyl chloride, ABS, nylon 6/6, nylon 6/10, and polyphenylene sulfide. Fair correlation was obtained between times to incapacitation and times to death. The relative rank order of materials, however, tended to be significantly different. 2 figs, 1 table, 3 refs. (Author)

2301. Hilado CJ, Slattengren CL, Kourtides DA and Parker JA

RELATIVE TOXICITY OF PYROLYSIS PRODUCTS OF SOME POLYURETHANE AND POLYCHLOROPRENE FOAMS

J Combust Toxicol; 4(1):21-31, 1977

Polyurethane and polychloroprene foams are widely used as flexible cushioning materials. Their fire response characteristics are of interest in many applications. Results of toxicity screening tests on some polyurethane and polychloroprene flexible foams are presented. The test method involves the exposure of four Swiss albino male mice in a 4.2-liter hemispherical chamber to the pyrolysis effluents from 1 g of sample exposed to temperatures rising from 200° to 800°C at a rate of 40°C/min. Mortality and times to incapacitation and to death are recorded. With this rising temperature method, the more toxic materials are associated with the generation of toxicants at lower temperatures. Comparisons indicate that flexible polyurethane foams without fire retardant are more toxic than the corresponding foams containing fire retardant, and polychloroprene foams are least toxic. The flexible polyurethane foams were based on a hybrid propoxylated epoxylated glycerine triol. Some samples contained no fire retardant, and others contained 12 percent tetrakis(2-chloroethyl)ethylene diphosphate. 2 figs, 4 tables, 10 refs. (Author)

2302. Hilado CJ and Schneider JE

TOXICITY STUDIES OF A POLYURETHANE RIGID FOAM

J Combust Toxicol; 4(1):79-86, 1977

Relative toxicity tests were performed on a polyurethane rigid foam containing a trimethylolpropane-based polyol and an organophosphate flame retardant, a type of combination reported to be unusually toxic. No unusual toxicity was observed with either gradual or rapid pyrolysis to 800°C in the absence of air flow. Convulsions and seizures similar to those previously reported were observed when the material was essentially flash pyrolyzed at 800°C in the presence of air flow, and the toxicity appeared unusual because of the dramatic effect rather than because of low sample weights required to produce death. 4 tables, 8 refs. (Author)

2303. Jenkins LJ, Jr, Jones RA and Anderson ME

THE USE OF MEAN SURVIVAL TIME ANALYSIS TO DETERMINE COMPARATIVE TOXICITY OF FIRE ATMOSPHERES

J Combust Toxicol; 4(1):87-96, 1977

Personnel survival in a fire is often determined by the toxicity of the atmosphere generated by the fire. The composition of the atmosphere is determined by the materials that are being combusted and the conditions under which they are burned. A method utilizing mean survival time measurements of rodents has been developed that provides a relatively rapid and inexpensive way of comparing the toxicity of fire atmospheres so that designers can have the necessary information to substitute less hazardous materials whenever possible. 6 figs, 2 tables, 6 refs. (Author)

10. HUMAN BEHAVIOR, SOCIAL, AND MEDICAL PROBLEMS

b. Combustion Toxicology—Continued

2304. Peabody HD
PULMONARY FUNCTION AND THE FIRE FIGHTERS
J Combust Toxicol; 4(1):8-15, 1977

It is usually assumed that the lungs of a firefighter may be subject to a great amount of irritation and potential damage. The fireman has been considered a "smoke-eater," and exposure is part of his job. However, very little concrete information is available about pulmonary function evaluation in the firefighter, who is faced with potentially hazardous inhalation exposure daily. In order to know what exposure to inhalation of smoke and toxic gases may do to pulmonary mechanics, it is desirable to have a normal lung function reference (age and height related) and a normal regression formula according to age. Also needed is additional information about the acute and chronic effects of inhalation of combustible products on the lung function of the firefighter. From such studies it is hoped to develop regression formulae in the firefighter and relate this to the findings in the general population. There is adequate information in the medical literature about pulmonary function in the normal population, as well as in persons with acute and chronic pulmonary disease. There are many studies on risk factors in the general population, and an adequate number of long-term and interpolative studies to estimate longevity and the effect of risk factors on morbidity and mortality. For the firefighter, however, there is very little information about risk factors and no adequate long-term studies on pulmonary function from which regression formulae may be developed. In this paper an attempt is made to fill a few gaps in our information relative to the pulmonary status of the firefighters. 1 fig, 6 tables, 13 refs. (Author)

2305. Saito F
EVALUATION OF THE TOXICITY OF COMBUSTION PRODUCTS
J Combust Toxicol; 4(1):32-55, 1977

In order to achieve rational safety countermeasures against the heat, smoke and gases of combustion products in fires, all of which inhibit escape of humans, it is necessary to know these products and to evaluate their toxicity. The smoke described in this article is treated as a factor inhibiting the range of vision, which is evaluated by an optical characteristic value (the coefficient of light diminution). A logical system is established and the relation between the smoke concentration and effective range of vision (the threshold limit concentration) is clarified. The threshold limit of gas concentration is not found, and it is difficult to establish plans for smoke prevention. 11 figs, 4 tables, 7 refs.

2306. Tsuchiya Y
NEW JAPANESE STANDARD TEST FOR COMBUSTION GAS TOXICITY
J Combust Toxicol; 4(1):5-7, 1977

Adoption of a toxicity test has been announced in the latest revision of the Japanese building standard law (Ordinance of the Ministry of Construction No. 1231, dated August 25, 1976; effective April 1, 1977). According to the revision, "fire-preventive materials grade 2 and grade 3" have to meet the toxicity test in addition to the flammability test and the smoke test. Grade 2 materials include cement fiberboard and gypsum board; grade

3 materials include fire-retardant plywood, fire-retardant fiberboard and fire-retardant plastics; grade 1 materials are non-combustible. The standard test determines incapacitation time of mice that are placed in rotary cages and exposed to combustion gases. The incapacitation is detected as mice cease to rotate the cages. 1 fig. (Author)

2307. Yamamamoto K
ACUTE COMBINED EFFECTS OF HCN AND CO, WITH SPECIAL REFERENCE TO A THEORETICAL CONSIDERATION OF ACUTE COMBINED EFFECTS ON THE BASIS OF THE BLOOD CYANIDE AND COHB ANALYSES
J Combust Toxicol; 4(1):69-78, 1977

On the assumption that the acute toxicities of HCN and CO are proportional to their concentration-exposure time (ct) products and that blood concentrations of cyanide and CO depend upon their ct products, an equation relating acute combined effects of HCN and CO with their blood concentrations was derived. In deriving the equation, death of the animal was used as an index of the acute toxicity. The application of the equation to the data on the blood CO and cyanide levels of rats acutely exposed to the combustion products from various combinations of Polyacrylonitrile-gauze mixtures was discussed. 2 figs, 1 table, 17 refs. (Author)

2308. Hilado CJ and Lopez MT
PROCEDURES FOR SCREENING MATERIALS FOR POTENTIAL FIRE TOXICITY AND DATA ON SOME MATERIALS FOUND IN THE HOME
J Consumer Prod Flammability; 4(1):40-59, 1977

The procedures used for screening materials for potential fire toxicity can be divided into two groups: those intended to simulate the pre-flashover conditions of a developing fire, and those intended to simulate the post-flashover conditions of a fully developed fire. The procedures used at the University of San Francisco employ a rising temperature program to simulate the developing fire and a fixed temperature program to simulate the fully developed fire. The rising temperature program has been used in most of the work to date, because toxicity is more critical to the occupants of the room in the pre-flashover stage than in the post-flashover stage. Data are presented to illustrate the different types of information obtained, reproducibility, the effect of test variables such as temperature program and air flow, and the effect of material variables such as flame retardants, fabric dyes, and fabric type. 9 figs, 19 tables, 18 refs. (Author)

2309. Anon
COMMITTEE ON FIRE TOXICOLOGY SIX-MONTH PROGRESS REPORT. Nat Acad Sci, Nat Res Council, Advisory Center on Toxicol, Washington, DC; NAS ACT/P-843-1, 11 pages, Jul 1976
 Availability: NTIS AD-A033 028/2GA

This report outlines desirable characteristics for a screening test for determining the toxicity of combustion and pyrolysis products of polymeric materials.

2310. Alarie Y and Barrow SC
TOXICITY OF PLASTIC COMBUSTION PRODUCTS. TOXICOLOGICAL METHODOLOGIES TO ASSESS THE RELATIVE HAZARDS OF THERMAL DECOMPOSITION

10. HUMAN BEHAVIOR, SOCIAL, AND MEDICAL PROBLEMS

b. Combustion Toxicology—Continued

TION PRODUCTS FROM POLYMERIC MATERIALS.
Univ Pittsburgh, Graduate School of Publ Health, Pittsburgh, PA; NBS GCR-77-85, 286 pages, 77 figs, 47 tables, 149 refs, Feb 1976
Availability: NTIS

Sensory and pulmonary irritation effects of thermal degradation products from natural and synthetic materials were studied using mice. Mice were used to develop a sensory irritation stress index based on changes in respiratory rate. In addition, acute lethality was obtained. Dose-response curves were generated for decomposition products from Douglas Fir, PVC, flexible polyurethane, teflon, and fiberglass reinforced polyester. Similar data were obtained for CO, CO₂, low O₂, acrolein, HCl and Cl₂. Preliminary studies on the pulmonary effects of combustion products using rabbits are also reported.

c. EMERGENCY MEDICAL SERVICES AND FACILITIES

2311. Jelenko C, III and Frey CF
EMERGENCY MEDICAL SERVICES: AN OVERVIEW
Robert J. Brady Co, Bowie, MD; 360 pages, 1976

Twenty-seven scholars and clinicians contributed to this book, written for Emergency Medical Service planners, educators, and others involved with public health. Designed to give the reader an understanding of the interrelationships and functions of an EMS program, it covers emergency care from first aid to critical care. The text deals with pre-hospital care and EMT training, emergency department physician training, emergency department procedures, critical care facilities, and community and disaster aid planning. One chapter, called "Medicolegal Implications of Emergency Care," discusses the timely issue of the legal ramifications of EMS.

d. INJURIES AND FATALITIES

2312. Anon
REDUCING FIRE DEATHS IN NURSING HOMES
Fire J; 70(5):11, 1976

The basic multiple-death fire safety problem in health care facilities is the failure to confine a fire's resultant heat and smoke to the room of origin. The combustibility of the sleeping-room contents intensifies the problem. Time is insufficient to safely evacuate the occupants. The development of the fire must be slowed down, or its effects must be confined, by closing the door to the room of origin, eliminating or controlling the smoke, or by extinguishing the fire. Some of the ways to reduce the risk of multiple-death fires in fire-resistive nursing homes include smoke detection, smoke control systems, reduction of combustible contents, door closers, sprinkler systems, and increased staff training. Three recent nursing home fires in the Chicago area, all occurring in fire-resistive facilities, are reported in succeeding pages to illustrate the problem: the Wincrest Nursing Home fire, Jan 30, 1976 (pp 12-15); the Cermak House fire, Feb 4, 1976 (pp 18-21); and the Plaza Nursing Centre Fire, Feb 18, 1976 (pp 24-27).

2313. Dolinin VA, Burmistrov VM and Buglaev AI
MULTI-FACTOR LESIONS DURING FIRES
Voен Med Zh; (5):27-30, 1976 (Russian)

Injuries received during massive fires and fires in enclosed spaces are reviewed in order to determine the causes, nature, and features of the clinical forms of such injuries. The study material consisted of 153 case histories of casualties arriving in the treatment center within the first few hours after fires in enclosed spaces and 108 forensic autopsy protocols of fire fatalities. The observations showed that fires in enclosed spaces most often result in complex injuries, due etiologically to the effects of several factors, that is, multi-factor injuries: of the 261 cases examined, there were 621 lesions. 2 tables, 9 refs.

e. PHYSIOLOGY

2314. Petroff PA, Hander EW, Clayton WH and Pruitt BA, Jr
PULMONARY FUNCTION STUDIES AFTER SMOKE INHALATION. Brooke Army Med Center, Army Inst Surg Res, Fort Sam Houston, TX; AD-A033 157/9GA, 6 pages, 1976
Availability: NTIS

Pulmonary function studies were performed within 72 hours of injury in seven patients with smoke inhalation injury diagnosed by positive Xe(133) scintiphotographs and in eight patients with burns of similar size but with negative Xenon 133 scans. The former patients showed decreased peak flow, decreased flow at 25, 50 and 75 per cent of vital capacity, and an elevated pulmonary resistance. In addition, single breath nitrogen tests revealed evidence of maldistribution of ventilation/perfusion abnormalities. Total lung capacity, functional residual capacity, and compliance (both dynamic and static) were similar in the two groups. Pulmonary function studies can be of assistance in evaluating smoke inhalation, estimating the severity, and following the course of patients with this disorder. (See also *FTA* 1(5) for an abstract of the same article published in *Am J Surgery*, 132(3):346-351, 1976.) (Author)

f. PSYCHOLOGY

11. CODES, STANDARDS, SAFE HANDLING, IDENTIFICATION OF HAZARDS

a. CODES

2315. Miller DE
OCCUPATIONAL SAFETY, HEALTH AND FIRE INDEX. VOL 1
Marcel Dekker, Inc, New York, NY, 224 pages, 1976

The passage of the United States Occupational Safety and Health Act of 1970 opened a new chapter in the history of industrial safety regulation. This book provides a comprehensive and unified reference listing of the safety, health, and fire codes, standards, guides, and publications in the field. Since the information is being developed too rapidly for any one volume to be current, annual cumulative supplements to this volume will be published to include the latest available information. The

11. CODES, STANDARDS, SAFE HANDLING, IDENTIFICATION OF HAZARDS

a. Codes—Continued

book is directed chiefly to industrial personnel engaged in health and safety activities, and will also be of use to engineering, legal, educational, labor and governmental groups in the development of ongoing programs in occupational safety and health. (Author)

2316. Gaignou A
SMOKE REMOVAL

Ann Inst Tech Batim Trav Publics; 29(341):68-69, 1976 (French)

The necessity of removing smoke during a fire is based on three important facts: the toxicity of smoke, the lack of visibility, and the excessive heat. The possibilities of diluting the smoke gases (combustion products), improving visibility and reducing temperatures can all be achieved by smoke removal systems. Regulations for smoke removal from highrise buildings were introduced in France in 1974. Pertinent regulations for public-access buildings are presently being developed.

2317. Malaval B
FRENCH FIRE REGULATIONS

Ann Inst Tech Batim Trav Publics; 29(341):52-53, 1976 (French)

A brief description is given of the process of development of French fire regulations as they pertain to building designers, from the draft stage by administrative authorities (Public Safety), through application by designers, to supervision. The different kinds of fire safety texts, namely, those which establish the test and classification methods and those which determine the requirements for type of premise, are discussed.

2318. Maltete L
THE PUBLIC SAFETY VIEWPOINT

Ann Inst Tech Batim Trav Publics; 29(341):48-49, 1976 (French)

At the present time, many regulations on fire safety in France are undergoing revision. In the near future regulations on the use of building materials, as a function of their combustibility, as well as a decision regulating the toxicity of gases released during the burning of some synthetic materials, will be published. Some sections of the fire code for highrise buildings are being refined. Fire codes for 3- and 4-family residences are also in need of revision. Also presently being reviewed is the 1917 law for buildings classified as being hazardous, inconvenient or unhealthy. Many other problems remain to be solved, but the lack of personnel on the public safety level required these problems to be dealt with one by one.

2319. Motteu H
THE VIEWPOINT OF BELGIAN CONSTRUCTORS

Ann Inst Tech Batim Trav Publics; 29(341):57-65, 1976 (French)

The four governmental sources of fire protection regulations in Belgium are identified, along with their spheres of responsibility. The research work being done to provide the data required for code development and the results achieved in the last two years are reviewed. The Belgian standards for fire protection in buildings, especially highrise buildings, are outlined. 6 figs, 2 tables.

2320. Anon
TECHNICS: LIFE SAFETY IN HEALTH CARE FACILITIES. WHERE THERE'S FIRE THERE'S SMOKE
Progr Archit; (9):58-63, 1976

There is little unanimity among the various codes and American government agencies on what constitutes the appropriate design for safety from fire. Most codes are composed of a multitude of well-intentioned but often self-defeating rules aimed at preventing the same disaster from re-occurring. An all-embracing national code responsive to new fire research findings is required, but there is nothing available so far. The pitfalls and confusion in the various current regulations on life safety design are considered. The need for an interlocked chain of action is outlined. Recommendations for detector-activated automatically closing doors in patients' rooms are the subject of much controversy. Automatic sprinklers have a vital role to play in preventing the spread of fire. The construction of buildings and the required fire resistance of component parts is outlined. The value of fire control system detectors is assessed. Central control systems supervise all fire, smoke and ionization sensors and fire alarm and notification functions, but may also be used to control physical security, heating and air-conditioning, lighting, lifts, laundry and kitchen equipment, and waste disposal units. The wiring of such systems is considered. The consensus of opinion in the United States is that safety codes are essential, although they represent the minimum rather than the ideal. The answer to the problem is a well-trained staff maintaining good housekeeping standards that knows exactly what to do in an emergency.

b. HAZARDS IDENTIFICATION

2321. Wright CJ
NEW HAZARDOUS MATERIALS PLACARDS
Fire Eng; 130(3):21-23, 1977

The new system of uniform marking of hazardous materials in transit, to be implemented on July 1, 1977, is presented. The revised placarding system contains 17 new placards, which are identical for both rail and highway transportation. The new placards will be found on each side and each end of a motor vehicle or rail car carrying hazardous materials. The size, color, and other aspects of the new system are discussed and displayed in tables and a color illustration. 1 fig, 4 tables, 5 refs.

c. SAFE HANDLING OF HAZARDOUS MATERIALS

2322. Anon
HANDLING FLAMMABLE LIQUIDS
Hwy Heavy Construct; 119(5):30-31, 1976

Safe handling and storage of hazardous liquids require that approved practices be followed. These practices are readily available from the National Safety Council, the National Fire Protection Association, Factory Mutual Research, the Underwriters Laboratory, and from local and state safety codes. Most important in the prevention of fire are good housekeeping practices and a thorough knowledge of proper handling procedures, as discussed in the article. 3 figs.

11. CODES, STANDARDS, SAFE HANDLING, IDENTIFICATION OF HAZARDS

c. Safe Handling of Hazardous Materials—Continued

2323. Stoppa J
PROTECTIVE HEALTH, LABOR AND FIRE MEASURES FOR THE USE OF WOFASTERIL (BACTERICIDE)
Lebensm Ind; 23(6):267-268, 1976 (German; English and Russian Summaries)

Instructions regarding the handling of Wofasteril (a bactericide containing about 36-40% peracetic acid, about 20% acetic acid, about 35% water and hydrogen peroxide, and a maximum of 0.25% stabilizer) are presented by the manufacturing company (in abbreviated form and editorially revised). Also discussed are the appropriate legal regulations; the transportation code for hazardous goods is cited. Conclusions for the use of Wofasteril in the beverage industry are drawn. (Author)

2324. Wood WS
TRANSPORTING, LOADING, AND UNLOADING OF HAZARDOUS MATERIALS USING MOTOR VEHICLES
Prof Saf; 21(7):25-30, 1976

Safety in motor truck transport of hazardous cargo requires both improved rolling stock and the upgrading of carrier personnel through training. Identification of hazardous materials, accurate shipping papers, proper loading and unloading procedures, and correct use of placards are concerns of the Department of Transportation, as well as the shippers and carriers. Changes in regulations are being promulgated to simplify compliance and improve safety. Emergency information services such as the Manufacturing Chemists Association's CHEMTREC (Chemical Transportation Emergency Center) have proved valuable in times of spill or fire. 4 photos. (Author)

d. STANDARDS

2325. Robertson AF (Ed)
FIRE STANDARDS AND SAFETY
 Americal Society for Testing and Materials; 345 pages, 1977

This Special Technical Publication 614 of the American Society for Testing and Materials contains the papers presented at the Symposium on Fire Standards and Safety held at the National Bureau of Standards, Gaithersburg, Maryland, on 5-6 April, 1976. The preprints of these papers were reviewed in *Fire Technology Abstracts*, Vol 1 Nos 1-2, where they can be found by consulting the Source Index under Symposia.

2326. Knoepfler NB
COTTON MATTRESSES THAT MEET FEDERAL STANDARD FF 4-72
Fire J; 70(5):53-55, 58-59, 1976

While the title of Federal Standard FF 4-72, *Mattress Flammability Standard*, implies a resistance to flaming combustion, it actually requires that the mattresses resist ignition by lighted cigarettes. Cotton mattresses ignited by lighted cigarettes rarely flame; the combustion is the very slow smoldering or glowing types. Phosphorous-containing compounds do not protect cotton batting against smoldering combustion initiated by cigarettes placed on mattress surfaces, although they are effective on fabrics. Boric acid treatment of cotton batting offers the best possibility for providing resistance to ignition by cigarettes in the context of *Mattress Flammability Standard* FF 4-72. 9 figs, 2 tables. (NFPA)

2327. Kerner G
EVALUATION OF FIRE RETARDANTS AND WOODEN BUILDING COMPONENTS IN ACCORDANCE WITH THE NEW STRUCTURAL FIRE PROTECTION GUIDELINES
Holzind; 29(9):258-259, 1976 (German)

The testing and licensing procedures for fire retardants and wooden building components in the German Democratic Republic (GDR) are outlined. The basic document, the State Building Inspectorate regulation No. 9/74, "Structural Fire Protection," which classifies the combustibility of building materials and the fire behavior of building components, is discussed. In effect as of 1 July 1976 is standard 10 685/12, "Determination of Fire Spread over Building and Structural Components." The stipulations of these standards and other regulations for structural fire protection are presented.

2328. Lin Y-N, Silverman M, Smith BF and Dardis R
COST-BENEFIT ANALYSIS OF FLAMMABILITY STANDARDS FOR CHILDREN'S SLEEPWEAR AND CLOTHING
J Consumer Prod Flammability; 4(1):5-28, 1977

The objectives of this paper were to investigate the role of cost-benefit analysis in evaluating consumer product safety standards and to apply such analysis to an evaluation of flammability standards for children's sleepwear and clothing, sizes 0-6X. The costs of safety standards included the costs of standard development and enforcement and the changes in consumer surplus due to product regulation. The benefits from safety standards were the reduction in product accidents and the direct and indirect costs of such accidents. The analysis demonstrated the impact of demand and supply conditions and the degree of protection provided by the standard on cost-benefit ratios. The results also indicated that the 0-6X Children's Sleepwear Standard was cost-effective in contrast to the hypothetical 0-6X Children's Clothing Standard, where high cost-benefit ratios existed. 3 figs, 11 tables, 23 refs. (Author)

2329. Braun E, Cobble VB, Krasny JF and Peacock R
DEVELOPMENT OF A PROPOSED FLAMMABILITY STANDARD FOR COMMERCIAL TRANSPORT FLIGHT ATTENDANT UNIFORMS. Nat Bureau of Standards, Center for Fire Res, Washington, DC; FAA RD-75-176, 193 pages, 96 figs, 3 tables, 10 refs, Aug 1976
 Availability: NTIS AD-A033 740/2GA

The objective of this work was to develop information to support a proposed flammability standard for flight attendant uniforms. Currently used uniforms were found to burn to varying degrees when exposed to a temporary small ignition source. The feasibility of designing uniforms with improved fire safety is demonstrated. Trade-offs in terms of cost, appearance, serviceability, and comfort are discussed. A proposed flammability standard for flight attendant uniforms is included. It describes the tests and qualifying criteria needed to add self-extinguishing characteristics and heat flux resistance to various types of F/A uniform items. (Author)

12. INSURANCE, ECONOMICS OF LOSS AND PREVENTION

12. INSURANCE, ECONOMICS OF LOSS AND PREVENTION**a. INSURANCE**

2330. Roux J-C

THE UNDERWRITERS' VIEWPOINT*Ann Inst Tech Batim Trav Publics*; 29(341):55-56, 1976 (French)

Insurance premiums, methods of calculating insurance rates, methods of assessing the fire hazard of buildings and industries, and the requirements for building design as they apply in France are discussed.

2331. Anon

FIRE BEHAVIOR OF STRUCTURES*Face au risque*; (125):59-63, 1976 (French)

A study is made of the specific viewpoints of the insurance industry regarding simple premiums, those of industry, and the even more complex premiums of special enterprises. Of prime interest in the pyrolysis of structures insured according to these three premium levels are the quantities of gas and smoke emitted. Also of interest, however, is the stability and fire resistance of some modern building materials. Factors of even greater importance are possibilities of insulation and the composition of the building materials, especially the possibilities of preventive fire protection and active and effective firefighting. The difficulties for the insurance industry, however, stem from the fact that some modern building materials contain manufacturing secrets that cannot be ferreted out. 4 figs. (Fachdok 13/0453)

b. LOSSES

2332. Bresle A

CORROSION DAMAGE FROM PVC FIRES*Kemia/Kemi*; 3(5):234-235, 1976 (Swedish)

The widespread use of plastics has brought about the problem of fighting the corrosion that occurs as a result of the effects of the combustion products generated during fires of plastics, especially those containing chlorine, such as PVC. During pyrolysis 1 kg of PVC forms 0.5 kg of gaseous hydrogen chloride which, when combined with water in a 4% concentration, yields 15% of an aggressive acid, sufficient to cover an area of 150m² with a 0.1 mm layer. As a result of corrosion, fire losses increase appreciably. The existing methods of cleaning equipment are not yet adequately effective and need further improvement. 2 figs, 1 table.

2333. Rardin RL and Mitzner M

DETERMINANTS OF INTERNATIONAL DIFFERENCES IN REPORTED FIRE LOSS: PRELIMINARY INVESTIGATION — INTERIM REPORT. Georgia Inst Technol, School Ind Syst Eng, School Social Sci, 79 pages, 11 tables, 350 refs, Dec 1976
Availability: NFPCA

As a first effort at obtaining some understanding of international fire losses, the National Fire Prevention and Control Administration has sponsored a study of the determinants of international differences in reported fire loss

(DDFire). DDFire is an inter-disciplinary, exploratory investigation of the causes of reported international differences in fire loss. Its principal objective is to develop hypotheses that might explain the differences and, whenever possible, to scan the hypotheses with readily available information. This interim report summarizes progress through November 1976. Detailed analyses are presented of two classes of hypotheses, those dealing with the compilation of fire statistics and those dealing with the relation between sociological phenomena and fire loss. The results should be considered tentative and subject to change in the final report.

c. RESTORATION

2334. Ruffert G

FIRE DAMAGE IN CONCRETE STRUCTURES - INVESTIGATIONS, ASSESSMENT, AND REPAIR*Beton Herstellung Verwend*; 26(7):239-243, 1976 (German)

Considered in this article are investigations into the factors that determine fire damage, such as the intensity and extent of the fire as well as the type and dimensions of the construction. Well-proved repair methods are discussed, as are shotcreting and injection with resin. (Author)

2335. Ruffert G

THE USE OF THE CONCRETE INJECTION TECHNIQUE (GERMAN STANDARD DIN 18 551 — INJECTED CONCRETE, MANUFACTURE AND TESTING) TO REPAIR FIRE-DAMAGED CONCRETE STRUCTURES*Schadenprisma*; 6(1):11-15, 1977 (German)

To supplement the standard DIN 18 551, "Injected Concrete," guidelines will soon be promulgated for the repair and reinforcement of concrete structures. This technique will make it possible to completely restore fire-damaged concrete structures that would otherwise have to be demolished. The types of damages to concrete and steel exposed to heat and HCl, resp, are described. The guidelines require the following points to be fulfilled before employing this new standard: 1) adequate quality of the concrete, that is, it must be at least as strong as the concrete to be restored; 2) adequate adhesion bond to take up all the forces occurring in the joint; and 3) participation of the new concrete in absorbing stresses, that is, adequate deformability of the old concrete so that the new concrete can take on stress. 6 figs. (Fachdok 13/0386)

d. RISK MANAGEMENT

2336. Rasbash DJ

THE DEFINITION AND EVALUATION OF FIRE SAFETY*Fire Prev Sci Technol*; (16):17-22, 1977

In recent years analytical and mathematical methods of evaluating fire safety, "systems" approaches, "cost effectiveness" approaches, and the use of hazard analyses and fault tree analyses have appeared in fire safety literature. In order to test the validity of these new methods and to incorporate them into the traditional methods of considering fire safety, it is necessary to define the steps

12. INSURANCE, ECONOMICS OF LOSS AND PREVENTION

d. Risk Management—Continued

that need to be covered in producing fire precautions. Initially it is necessary to define the nature of the hazard and thus the probability of a fire being caused. Then the course of the fire, the production of harmful agents, and the total expectation of loss and harm by fire can be considered. These studies enable reasonable requirements for fire precautions in the hazardous area to be formulated. This procedure can be broken down into at least the 20 steps described in this article. 1 fig, 8 refs. (Author)

2337. Lorenzen H and Werner K-W

FIRE DAMAGES AT BUILDING SITES — RESULT OF AN INQUIRY OF LEGAL PUBLIC UNDERWRITERS

Schadenprisma; 6(1):15-18, 1977 (German)

An investigation of 170 cases of damages, selected to be representative, revealed that of a total damage value of 37 million marks, damages from machinery, processing of fire-hazardous materials, and damages from other sources, such as fire, light, and heat, amounted to 26.4 million marks, or 71%. A further breakdown of the cases showed that disproportionately high damages result from handling of combustible building materials, welding and soldering work. It is urgently required that fire-protection regulations and protective measures derived from these regulations be followed at construction sites. 4 figs, 3 tables, 7 refs. (Fachdok 13/0410)

e. SALVAGE

13. STATISTICS

2339. Anon

FIREWORKS INCIDENTS, 1976

Fire J; 70(6):74-77, 82, 1976

A brief report is made of the 1976 fireworks statistics, covering 768 fireworks-related incidents that caused 5 deaths, 72 serious injuries, and 691 minor injuries. In addition, 846 fires were attributed to the indiscriminate use of fireworks. Two tables summarize the number of incidents by type of fireworks and a sample of 1976 fireworks injuries. Brief accounts of fatalities and serious injuries are given. 2 photos, 2 tables.

2340. NFPA Fire Anal Dept

MULTIPLE-DEATH FIRES, 1975

Fire J; 70(4):27-29, 51, 1976

In 1975 there were 250 multiple death fires with 1091 deaths more than in the previous four years. However, there was no multiple death fire reported in a nursing home in 1975. There were seven fires, causing from 10 to 108 deaths, ranging from a jail fire to a plane crash and fire with 108 deaths (15 caused by the fire). There were 29 killed in a tanker explosion and fire when a cargo ship collided with a docked tanker. Over 75% of the deaths in multiple death fires occurred in residential occupancies. Again, one- and two-family dwellings accounted for most of the deaths — 55%. 2 figs, 4 photos, 3 tables, 4 refs. (NFPA)

2341. NFPA Fire Anal Dept

1975 LARGE-LOSS FIRES IN THE UNITED STATES

Fire J; 70(5):37-42, 1976

Although there were 9% fewer large-loss fires in 1975 than in 1974, there was a 2% increase in dollar losses, caused primarily by the \$70 million loss in the New York central telephone exchange, which was one of the largest fire losses in modern history. If this loss had been excluded, the average dollar loss would have decreased by 1.2%. There were 25 losses more than \$3 million, which totaled \$259.7 million. There were 4 aircraft fires that involved \$50 million in losses. A fire in a foam rubber manufacturing plant attributed to arson resulted in a \$24 million loss. A fire in a trolley car storage warehouse in Philadelphia involved a \$25 million loss. 4 photos, 6 tables. (NFPA)

2342. NFPA Fire Anal Dept

FIRES AND FIRE LOSSES CLASSIFIED, 1975

Fire J; 70(6):17-19, 1976

US fire deaths increased from 11,600 to 11,800 in 1975, including 165 firefighters. Fire injuries increased to 131,000 in 1975, with more than half involving firefighters. Most of the fire deaths, 72% of the building fires, and 40% of the property loss from fires occurred in residences. Fire losses increased by 9.5% to exceed \$4 billion for the first time. Incendiary and suspicious fires increased by 25.5%, with an increase in property loss of 12.5%. Large loss fires, which comprised only 0.02% of all fires, caused 14.1% of all damage. 4 tables, 1 ref. (NFPA)

2343. Anon

FACTS AND FIGURES ABOUT THE 20,000 PLUS POUNDS FIRES IN 1975

Fire Prev; (118):11-15, 1977

The 1,152 fires in Great Britain that caused damage of 20,000 or more pounds in 1975 are analyzed in 8 charts and tables. These fires accounted for 128,221,000 of the 213 million pounds annual total estimated loss for Great Britain. The charts and tables are: 1) Breakdown of Fires by Occupancy; 2) Grading of Losses; 3) Fire Costs Related to Production; 4) Industries in Which Fires Most Frequently Grew Into 20,000-Plus Pounds Fires; 5) How the Fires Started; 6) Where the Fires Started; 7) When the Fires Started; and 8) Age of Premises Involved. The average cost of the 1,152 fires analyzed in this survey was about 111,000 pounds. Sixteen of the fires cost over 1,000,000 pounds each. 3 photos, 8 tables.

2344. Anon

FPA CASEBOOK OF SOME RECENT MAJOR FIRES

Fire Prev; (118):27-44, 1977

The FPA casebook contains a statistical compilation of major fire damage in the UK for October-November-December, 1976, and a brief description of some notable non-UK fires for the same period. Seven major fires are discussed in terms of main features, including estimated damage, description of premises, cause of fire, and narrative of the fire. Other notable fires in industrial, commercial, public-access, marine, residential and institutional premises are described in brief. Illustrations, diagrams and photographs accompany the various incidents.

2345. Redzic D

FIRES AND DAMAGES IN 1975

Protivpozarna Zastita; 16(9):15-24, 1976 (Serbocroatian)

13. STATISTICS

e. Salvage—Continued

Yugoslavian fire statistics for 1975 reveal an increase in the number of fires by 10%, in the number of fatalities by 50%, and in property damage by 60%. The report gives data on the causes of the fires, the value of damages, the branches of industry hit by fire, and damaged private property. The most frequent cause of fire was negligence. Ship construction was hit with the greatest damages. Also reported are successful fire department responses and assistance by the population. In 74% of the cases the fire department was at the fireground within 10 minutes. 7 figs, 9 tables. (Fachdok 13/0397)

2346. Powers WR

ELECTRICAL FIRES IN NEW YORK CITY — 1976.

Soc Fire Prot Engrs, Boston, MA; SFPE TR-77-3, 5 pages, 1977

Availability: SFPE

The Fire Patrol of the New York Board of Fire Underwriters issues a bulletin every day giving some details on all fires in New York City. This survey, based on such information obtained on the 2867 fires identified in 1976 as being electrical in origin, discusses not only the cause of electrical fires but their prevention. Surprisingly enough, 38%, or 1079, of the electrical fires occurred at light fixtures, switches, and outlets. These are the points of most frequent interruption of current, arcing and mechanical abuse. Motors were responsible for 530 fires, or 19% of the electrical fires, with elevators responsible for 142 of these, or 5% of the total electrical fires. Old age, which resulted in dried out, cracked insulation, distorted windings and worn bearings, was the most common cause of motor fires. In addition to a discussion of electrical fire causes, there is a list of practical precautions to be followed to prevent electrical fires. (Author)



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EXPANSIONS OF JOURNAL ABBREVIATIONS

Accid Anal Prev	<i>Accident Analysis and Prevention</i>	spalania [Archives of Thermodynamics and Combustion]
Acta Univ Upsaliensis	<i>Acta Universitatis Upsaliensis</i> [Transactions of Uppsala (Sweden) University]	Aromatikkusu <i>Aromatikkusu</i> [Aromatics]
Adv Fire Retard Text, Prog Fire Retard Ser	<i>Advances in Fire Retardant Textiles, Progress in Fire Retardancy Series</i>	ASCE Proc. J Struct Div <i>American Society of Civil Engineers. Proceedings. Journal of the Structural Division</i>
Air Cosmos	<i>Air et Cosmos</i> [Air and Space]	ASHRAE J <i>American Society of Heating, Refrigerating and Air-Conditioning Engineers Journal</i>
Allg Forstztg	<i>Allgemeine Forstzeitung</i> [General Forestry Gazetteer]	ASME Trans. Ser C. J Heat Transfer <i>American Society of Mechanical Engineers. Transactions. Series C. Journal of Heat Transfer</i>
Am Chem Soc, Div Org Coat Plast Chem, Prepr	American Chemical Society, Division of Organic Coatings and Plastics Chemistry, Preprints	ASME Trans. Ser H. J Eng Mater Technol <i>American Society of Mechanical Engineers. Transactions. Series H. Journal of Engineering Materials and Technology</i>
Am Ind Hyg Assoc J	<i>American Industrial Hygiene Association Journal</i>	ASTM Standardization News <i>American Society for Testing and Materials. Standardization News</i>
Am J Surg	<i>American Journal of Surgery</i>	Aviat, Space and Environ Med <i>Aviation, Space and Environmental Medicine</i>
Am Water Works Assoc J	<i>American Water Works Association Journal</i>	Bauplanung Bautech <i>Bauplanung & Bautechnik</i> [Building Design & Building Engineering]
Amts- und Mitteilungsbl Bundesanst Materialpruef	Amts- und Mitteilungsblatt der Bundesanstalt fuer Materialpruefung [Official Gazette and Communications of the Federal Bureau for Materials Testing]	Bautechnik <i>Bautechnik</i> [Construction Engineering]
Anesth Analg	<i>Anesthesia and Analgesia</i>	BBC-Nachr. .. <i>Brown-Boveri und Compagnie - Nachrichten</i> [Bulletin of the Brown-Boveri Company]
Anesthesiol	<i>Anesthesiology</i>	Beratende Ing <i>Beratende Ingenieure</i> [Consulting Engineers]
Ann Clin Lab Sci	<i>Annals of Clinical Laboratory Science</i>	Berufsgenoss <i>Berufsgenossenschaft</i> [Employer's Liability Insurance]
Ann Inst Tech Batim Trav Publics	<i>Annales de l'Institut Technique du Batiment et des Travaux Publics</i> [Annals of the Technical Building and Civil Engineering Institute]	Beton Herstellung Verwend <i>Beton-Herstellung und-Verwendung</i> [Concrete Production and Use]
Ann Mines	<i>Annales des Mines</i> [Mine Annals]	Betonwerk <i>Betonwerk + Fertigteil-Technik</i> [Concrete Work + Finished Parts Engineering]
Ann Surg	<i>Annals of Surgery</i>	Beton Zhelezobeton <i>Beton i Zhelezobeton</i> [Concrete and Reinforced Concrete]
Antincendio protez civ	<i>Antincendio e Protezione Civile</i> [Fire and Public Protection]	Betr Manage Ser <i>Betriebs-Management Service</i> [Plant Management Service]
Apave	<i>Revue technique du groupement des associations de proprietaires d'appareils a vapeur et electriques</i> [Technical Review of the Group of Associations of Steam and Electrical Equipment Owners]	Bezop ekspluat elektromekh oborud v shakhtakh Bezopasnost ekspluatatsii elektromekhanicheskogo oborudovaniya v Shakhtakh [Safety of Operation of Electromechanical Equipment in Mines]
Appl Ergon	<i>Applied Ergonomics</i>	Bezop tr prom-sti <i>Bezopasnost truda v promyshlennosti</i> [Occupational Safety in Industry]
Arch Mal Prof Med Trav Secur Soc	<i>Archives des Maladies Professionnelles, de Medecine du Travail et de Securite Sociale</i> [Archives of Professional Diseases, Industrial Medicine and Public Safety]	Boei Daigakko Rikogaku Kenkyu Hokoku <i>Boei Daigakko Rikogaku Kenkyu Hokoku</i> [Scientific and Engineering Reports of the Defense Academy of Japan]
Arch Ophthalmol	<i>Archives of Ophthalmology</i>	Bor'ba gazom, pyl'yu i vybrosami v ugol'n shakhtakh
Arch Surg	<i>Archives of Surgery</i>	
Arch Termodyn Spal	<i>Archiwum termodynamiki i</i>	

EXPANSIONS OF JOURNAL ABBREVIATIONS

Bor'ba s gazom, pyl'yu i vybrosami v ugol'nykh shakhtakh [Prevention of Gas, Dust and Discharges in Coal Mines]	Constr Specifier..... Construction Specifier
Brandaus..... Brandaus [All Out]	Consult Eng..... Consulting Engineer
Brandforsvar..... Brandforsvar [Fire Protection]	Cour Norm..... Courrier de la Normalisation [Standardization Bulletin]
Brandforsvar, FoU-Brand..... Brandforsvar, FoU-Brand [Fire Protection, Research Bulletin]	Denki gakkai zasshi..... Denki gakkai zasshi [Journal of the Institute of Electrical Engineers of Japan]
Brandhilfe..... Brandhilfe [Fire Assistance]	Denki kikansya..... Denki kikansya [Electrical Machinery]
Brandschutz..... Brandschutz [Fire Protection]	Denpa Jiho..... Denpa Jiho [Journal of the Radiowave Control Bureau]
Brandvaern..... Brandvaern [Fire Protection]	Denryoku to tetsudo..... Denryoku to tetsudo [Electric Lighting and Facilities in Railways]
Brandverhuetung..... Brandverhuetung [Fire Prevention]	Densetsu kogyo..... Densetsu kogyo [Electrical Construction Engineering]
Brandwacht..... Brandwacht [Firewatch]	Diesel Gas Turbine Progr..... Diesel and Gas Turbine Progress
Brauwelt..... Brauwelt [Brewing World]	Dimensions in Health Serv.... Dimensions in Health Service
Brewers Digest..... The Brewers Digest	Dimensions/NBS..... Dimensions/National Bureau of Standards
Brit J Ind Med..... British Journal of Industrial Medicine	DIN Mitt..... Deutsche Industrie-Normen Mitteilungen [German Industrial Standards Bulletin]
Brown Boveri Mitt..... Brown-Boveri Mitteilungen [Communications from the Brown-Boveri Company]	Diteru..... Diteru [Detail: Magazine for Architects and Engineers]
Build Serv Eng..... Building Services Engineers	Draegerheft..... Draegerheft [Draeger Bulletin]
Build Stand..... Building Standards	Dtsch Ausschuss Stahlbeton..... Deutscher Ausschuss fuer Stahlbeton [German Reinforced Concrete Committee]
Bull Inf Sci Tech..... Bulletin d'Informations Scientifiques et Techniques, Commisariat a l'Energie Atomique [Scientific and Technical Information Bulletin. Atomic Energy Commission]	Dtsch Farben Z..... Deutsche Farben-Zeitschrift [German Paint Journal]
Bull mens Chambre Commerce ind Meurthe-et-Moselle..... Bulletin mensuel de la Chambre du Commerce Industriel de Meurthe-et-Moselle [Monthly Bulletin of the Industrial Chamber of Commerce of Meurthe-et-Moselle]	Dtsch Mueller Z..... Deutsche Mueller Zeitschrift [German Miller Journal]
BVD/SPI Bull..... Brandverhuetungsdienst/Services de Protection Incendie Bulletin [Fire Prevention Service Bulletin]	Dupont Mag..... Dupont Magazine
Cah Cent Sci Tech Batim..... Cahiers du Centre Scientifique et Technique du Batiment [Communications of the Scientific and Technical Building Center]	Electr Commun..... Electrical Communication
Can J Civ Eng..... Canadian Journal of Civil Engineering	Electr Contract..... Electrical Contractor
Can Med Assoc J.... Canadian Medical Association Journal	Electron Des..... Electronics Design
Cement (Amsterdam)..... Cement (Amsterdam)	Electron Des News..... Electronics Design News
Cent Tech Bois. Bull Inf Tech..... Centre Technique du Bois. Bulletin d'Informations Techniques [Technical Center for Wood. Technical Information Bulletin]	Electron Ind..... Electronics in Industry
Cerberus Alarm..... Cerberus Alarm	Electron Power..... Electronics and Power
Chart Mech Eng..... Chartered Mechanical Engineer	Electro Rev..... Electro-Revue [Electrical Review]
Chem Eng..... Chemical Engineering	Elek-Prakt..... Elektro-Praktiker [Electrical Practitioner]
Chemik..... Chemik (Poland) [Chemist]	Elektriker..... Der Elektriker [The Electrician]
Chem-Ing-Tech..... Chemie-Ingenieur-Technik [Chemistry-Engineer-Technology]	Elektro Anz..... Elektro-Anzeiger [Journal of Electrical and Electronic Engineering]
Chem Tech..... Chemische Technik [Chemical Engineering]	Elektrotech Z..... Elektrotechnische Zeitschrift [Electrotechnical Journal]
Civ Eng..... Civil Engineering (New York)	Elektr Stn..... Elektricheskiye Stantsii [Electrical Power Stations]
Clin Res..... Clinical Research	Elettrotecn..... Elettrotecnica [Electrotechnology]
Coal Min Process..... Coal Mining and Processing	Engineer (London)..... The Engineer (London)
Combust Flame..... Combustion and Flame	Eng J..... Engineering Journal
Combust Sci Technol..... Combustion Science and Technology	Eng Min J..... Engineering and Mining Journal
Commer Motor..... Commercial Motor	Environ Health Perspect..... Environmental Health Perspectives
Concrete..... Concrete	Exchange..... Exchange
	Face au Risque..... Face au Risque [Facing the Risk.]

EXPANSIONS OF JOURNAL ABBREVIATIONS

Journal of the French National Prevention and Protection Center]	
Feuerwehr	<i>Die Feuerwehr</i> [The Fire Service]
Feuerwehrmann	<i>Feuerwehrmann</i> [Firefighter]
Fire	<i>Fire</i>
Fire Chief	<i>Fire Chief</i>
Fire Command	<i>Fire Command</i>
Fire Eng	<i>Fire Engineering</i>
Fire Eng J	<i>Fire Engineers Journal</i>
Fire Internat	<i>Fire International</i>
Fire J	<i>Fire Journal</i>
Fireline	<i>Fireline</i>
Fire Mater	<i>Fire and Materials</i>
Fire Prev	<i>Fire Prevention</i>
Fire Prev Sci Technol	<i>Fire Prevention Science and Technology</i>
Fire Prot Rev	<i>Fire Protection Review</i>
Fire Technol	<i>Fire Technology</i>
For Sci	<i>Forest Science</i>
Fune no kagaku	<i>Fune no kagaku</i> [Marine Engineering]
Gas Erdgas	<i>Gas- und Wasserfach, Gas-Erdgas</i> [Gas and Water Technology, Gas – Natural Gas]
Geriatrics	<i>Geriatrics</i>
Gig Sanit	<i>Gigiena i Sanitariya</i> [Hygiene and Sanitation]
GIT	<i>Glas-Instrumenten-Technik: Fachzeitschrift fuer das Laboratorium</i> [Glass Instrument Engineering: Professional Journal for the Laboratory]
Glueckauf	<i>Glueckauf</i> [Journal of Mining Engineering and Industry]
Glueckauf Forschungsh	<i>Glueckauf-Forschungshefte</i> [Glueckauf Research Journal]
Gorn elektromekh i avtomatika	<i>Resp mezhved temat nauch-tekhn sb. Gornaya elektromekhanika i avtomatika. Respublikanskiy mezhvedomstvennyy tematicheskii nauchno-tekhnicheskii sbornik</i> [Mining Electromechanics and Automation. Inter-agency Topical Scientific and Technical Digest of the Republics]
Gornospasat delo	<i>Gorno-spasatel'noye delo</i> [Mine Rescue]
Gornyi Zh	<i>Gornyi Zhurnal</i> [Mining Journal]
Gummi Asbest Kunstst	<i>Gummi, Asbest und Kunststoffe</i> [Rubber, Asbestos and Plastics]
Haikan gijitsu	<i>Haikan gijitsu</i> [Piping Engineering]
Hansa	<i>Hansa</i> [Journal of Shipping, Ship Construction and Harbors]
Heron	<i>Heron</i> [Journal of the TNO for Building Materials and Building Structures, The Netherlands]
Hessische Feuerwehr Z	<i>Hessische Feuerwehr-Zeitschrift</i> [Hessian Fire Service Journal]
HLH	<i>Zeitschrift fuer Heizung, Lueftung, Klimatechnik und Haustechnik</i> [Journal of Heating, Ventilation, Air Conditioning and Household Engineering]
HLK	<i>Heizung-Lueftung-Klimatisation</i> [Heating, Ventilating, Air Conditioning]
Holzind	<i>Holzindustrie</i> [Wood Industry]
Holzrundschau	<i>Holzrundschau</i> [Wood Review]
Hosp Top	<i>Hospital Topics</i>
Hwy Heavy Construc	<i>Highway and Heavy Construction</i>
Hydrocarbon Process	<i>Hydrocarbon Processing</i>
IEEE Proc	<i>Institute of Electrical and Electronics Engineers. Proceedings</i>
IEEE Spectrum	<i>Institute of Electrical and Electronics Engineers. Spectrum</i>
IEEE Trans Biomed Eng	<i>Institute of Electrical and Electronics Engineers. Transactions on Biomedical Engineering</i>
IEEE Trans Power Appar Sys	<i>Institute of Electrical and Electronics Engineers. Transactions on Power Apparatus and Systems</i>
Ind Digest	<i>Industrie Digest</i> [Industrial Digest]
Ind Eng	<i>Industrial Engineering</i>
Ind Eng Chem Prod Res Dev	<i>Industrial and Engineering Chemistry, Product Research and Development</i>
Ind Miner Mine	<i>Industrie Minerale, Mine</i> [Mineral Industry, Mines]
Ind Res	<i>Industrial Research</i>
Ind Tech	<i>Industrie et Technique</i> [Industry and Engineering]
Ind Vernice	<i>Industria della Vernice</i> [Varnish Industry]
Inf Constr	<i>Informes de la Construcccion</i> [Construction News]
Inf Process Manage ...	<i>Information Processing Management</i>
Ing Digest	<i>Ingenieur Digest</i> [Engineer's Digest/Materiels Nouveaux et Techniques Mondiales/Ingenieur Digest]
Inst Marine Engs, Trans	<i>Institute of Marine Engineers. Transactions</i>
Instrum Control Syst	<i>Instruments and Control Systems</i>
Instrum Technol	<i>Instrumentation Technology</i>
Internat Fire Chief	<i>International Fire Chief</i>
Iron Steel Eng	<i>Iron and Steel Engineering</i>
ISA Trans	<i>Instrument Society of America. Transactions</i>
Instalador	<i>Instalador</i> [Installers' Journal]
Izv Vyssh Uchebn Zaved. Gorn Zh	<i>Izvestiya Vysshikh Uchebnykh Zavedenii. Gornyi Zhurnal</i> [Bulletin of the Institutions of Higher Education, Mining Journal]
J Am Concr Inst	<i>Journal of the American Concrete Institute</i>
J Am Med Assoc	<i>Journal of the American Medical Association</i>
J Br Fire Serv Assoc and Ind Fire Prot Assoc	<i>Journal of the British Fire Service Association and the Industrial Fire Protection Association</i>
J Cell Plast	<i>Journal of Cellular Plastics</i>
J Chem Educ	<i>Journal of Chemical Education</i>
J Combust Toxicol	<i>Journal of Combustion Toxicology</i> (Quarterly Supplement to the Journal of Fire and Flammability)
J Consumer Prod Flammability	<i>Journal of Consumer</i>

EXPANSIONS OF JOURNAL ABBREVIATIONS

Product Flammability (Quarterly Supplement to the Journal of Fire and Flammability)	Lab Data Laboratory Data
J Faculty Eng, Univ Tokyo, Ser B <i>Journal of the Faculty of Engineering, University of Tokyo, Series B</i> [Tokyo Daigaku Kogakubu Kiyo, B (published in English)]	Lakokrasoch materialy i ikh primeneniye <i>Lakokrasochnyye materialy i ikh primeneniye</i> [Paints and Varnishes and their Application]
J Fire Flammability <i>Journal of Fire and Flammability</i>	Lebensm Ind . <i>Lebensmittel-Industrie</i> [Foodstuffs Industry]
J Fire Retard Chem <i>Journal of Fire Retardant Chemistry</i> (Quarterly Supplement to the Journal of Fire and Flammability)	Lenziger Ber <i>Lenzinger Berichte</i> [Lenzing (Co) Reports]
J For <i>Journal of Forestry</i>	Lub Eng <i>Lubrication Engineer</i>
J Mines Met Fuels <i>Journal of Mines, Metals and Fuels</i>	Manage Sci <i>Management Science</i>
J Mine Vent Soc S Africa <i>Journal of the Mine Ventilation Society of South Africa</i>	Maschinenmarkt <i>Maschinenmarkt</i> [Machinery Market]
J Occup Med <i>Journal of Occupational Medicine</i>	Maschinenschaden <i>Maschinenschaden</i> [Machine Failure]
J Pediatr <i>Journal of Pediatrics</i>	Mat Consts/Mat Struct <i>Materiaux et Constructions/Materials and Structures</i>
Jpn Railw Eng . <i>Japanese Railway Engineering</i> (in English)	Mater Eng <i>Materials Engineering</i>
J Polym Sci: Polym Chem Ed <i>Journal of Polymer Science: Polymer Chemistry Edition</i>	Mater Plast Elastomeri <i>Materie Plastique ed Elastomeri</i> [Plastic Materials and Elastomers]
J Polym Sci: Polym Lett Ed <i>Journal of Polymer Science: Polymer Letters Edition</i>	Medd fran Statens brandnamnd <i>Meddelanden fran Statens Brandnamnd</i> [Communications from the State Fire Administration]
J Prestr Concr Inst <i>Journal of the Prestressed Concrete Institute</i>	Med Leg J <i>Medico-Legal Journal</i>
J Psychiatr Nurs <i>Journal of Psychiatric Nursing and Mental Health Service</i>	Med Sci Law <i>Medicine, Science and the Law</i>
J Soc Automot Eng Jap <i>Journal of the Society of Automotive Engineers of Japan</i>	Melliand Textilber <i>Melliand Textilberichte</i> [Melliand Textile Journal]
J Text Inst <i>Journal of the Textile Institute</i>	Mil Eng <i>Military Engineer</i>
Kagaku Kogyo <i>Kagaku Kogyo</i> [Chemical Industry]	Min Congr J <i>Mining Congress Journal</i>
Kasai <i>Kasai</i> [Journal of the Japanese Association of Fire Science and Engineering]	Minn Fire Chief <i>Minnesota Fire Chief</i>
Keisoku jido seigo gakkai ronbunshu <i>Keisoku jido seigo gakkai ronbunshu</i> [Transactions of the Society of Instrument and Control Engineers]	Min Technol <i>Mining Technology</i>
Kemia/Kemi <i>Kemia/Kemi</i> [Chemistry]	Mitsubishi Denki Giho <i>Mitsubishi Denki Giho</i> [Mitsubishi Denki Technical Review]
Khim prom <i>Khimicheskaya Promyshlennost</i> [Chemical Industry]	Mitt Inst Bautech <i>Mitteilungen des Instituts fuer Bautechnik</i> [Communications of the Construction Engineering Institute]
Khlopk Prom <i>Khlopkovaya Promyshlennost</i> [Cotton Industry]	Mitt Inst Wasserbau Univ Stuttgart <i>Mitteilungen des Instituts fuer Wasserbau der Universitaet Stuttgart</i> [Communications of the Hydraulics Institute of Stuttgart University]
Klima Kaelteing <i>Klima + Kaelteingenieur</i> [Conditioning + Refrigerating Engineer]	Mod Plant Oper Maint <i>Modern Plant Operations Maintenance</i>
Koatsu gasu <i>Koatsu gasu</i> [Journal of the Institute of Safety in High Pressure Gas Engineering (Japan)]	Mod Plast <i>Modern Plastics</i>
Kogyo yosui <i>Kogyo yosui</i> [Industrial Water]	Motor Ship <i>Motor Ship</i>
K'o Hsueh Shih Yen <i>K'o Hsueh Shih Yen</i> [Scientific Experiments]	Naeringsmiddelindustrien <i>Naeringsmiddelindustrien</i> [Foodstuff Industry]
Kosoku doro to jidosha <i>Kosoku doro to jidosha</i> [Expressways and Automobile]	Nat Saf News <i>National Safety News</i>
Krankenhaus Umsch <i>Krankenhaus Umschau</i> [Hospital Review]	Nav Eng J <i>Naval Engineers Journal</i>
Kriminalistik <i>Kriminalistik</i> [Criminology]	Nav, ports, chant <i>Navires, Ports et Chantiers</i> [Ships, Ports and Yards]
Kuki tyowa to reito <i>Kuki tyowa to reito</i> [Air Conditioning and Refrigeration]	Neftyanik <i>Neftyanik</i> [The Petroleum Worker]
Kunstst <i>Kunststoffe</i> [Plastics]	Netsu kanri to Kogai <i>Netsu kanri to Kogai</i> [Heat Management and Pollution Control]
Kunstst J <i>Kunststoff-Journal</i> [Plastics Journal]	New Ships/Neubauten <i>New Ships/Neubauten</i>
Kunstst Plast <i>Kunststoffe-Plastics</i>	Nihon Jozo Kyokai Zasshi <i>Nihon Jozo Kyokai Zasshi</i> [Journal of the Society of Brewing, Japan]
	Nihon Kasai Gakkai Ronbunshu <i>Nihon Kasai Gakkai Ronbunshu</i> [Bulletin of the Fire Prevention Society of Japan]
	Nihon kenchiku gakkai ronbun hokokushu <i>Nihon</i>

EXPANSIONS OF JOURNAL ABBREVIATIONS

kenchiku gakkai ronbun hokokushu [Transactions of the Architectural Institute of Japan]	Industrielle [Public Protection and Industrial Security]
Not AICAP..... <i>Notizario AICAP</i> [Bulletin of the AICAP]	Protivpozarna Zastita..... <i>Protivpozarna Zastita</i> [Fire Protection]
Nuclear Saf..... <i>Nuclear Safety</i>	Prz bud..... <i>Przegląd Budowlany</i> [Building Review]
Nucl Eng Des..... <i>Nuclear Engineering and Design</i>	Prz poz..... <i>Przegląd pożarny</i> [Fire Review]
Nursing Homes..... <i>Nursing Homes</i>	PTT Tech Mitt..... <i>Technische Mitteilungen der Schweizerischen Post Telephon- und Telegraphenbetriebe</i> [Technical Information Journal of the Swiss Postal, Telephone and Telegraph Service]
Oesterr Feuerwehr..... <i>Oesterreichische Feuerwehr</i> [Austrian Fire Service]	Publ Pers Manage..... <i>Public Personnel Management</i>
Oesterr Z Elektrizitaetswirtsch..... <i>Oesterreichische Zeitschrift fuer Elektrizitaetswirtschaft</i> [Austrian Journal for the Electrical Industry]	Puranto Enjinia..... <i>Puranto Enjinia</i> [Plant Engineer]
Office..... <i>The Office</i>	Q Rep Railw Tech Res Inst (Japan)..... <i>Nihon Kokuyu Tetsudo Gijutsu Kenkyusho</i> [Quarterly Reports of the Railway Technical Research Institute (published in English)]
Offshore Serv..... <i>Offshore Service</i>	R/D..... <i>Research and Development</i>
Ohm: denki zasshi..... <i>Ohm: denki zasshi</i> [Ohm Journal]	Radiol Prot Bull..... <i>Radiological Protection Bulletin</i>
Oil Colour Chem Assoc J..... <i>Oil and Colour Chemists Association Journal</i>	Rep Fire Res Inst Japan..... <i>Reports of the Fire Research Institute of Japan</i> [Shobo Kenkyushu Hokoku]
Oper Res..... <i>Operations Research</i>	Rep Fire Sci Lab (Japan)..... <i>Reports of the Fire Science Laboratory of Japan</i> [Shobo Kagaku Kenkyushoho]
Packs (Japan)..... <i>Packs</i> [Pakkusu]	Rev Belge Feu..... <i>Revue Belge du Feu</i> [Belgian Fire Review]
Paper Technol..... <i>Paper Technology</i>	Rev Ind..... <i>Revue Industrielle</i> [Industrial Review]
PCI J..... <i>Prestressed Concrete Institute Journal</i>	Rev Sci Instrum..... <i>Review of Scientific Instruments</i>
Pediatrics..... <i>Pediatrics</i>	Rev Tech Feu..... <i>Revue Technique du Feu</i> [Fire Engineering Review]
Plaste Kautsch..... <i>Plaste und Kautschuk</i> [Plastics and Rubber]	R Soc Health J..... <i>Royal Society of Health Journal</i>
Plast Eng..... <i>Plastics Engineering</i>	R Soc Med Proc..... <i>Royal Society of Medicine Proceedings</i>
Plastforum..... <i>Plastforum</i> [Plastics Review]	Rubber Age..... <i>Rubber Age</i>
Plastica..... <i>Plastica</i> [Plastics]	Ryusan to kogyo..... <i>Ryusan to kogyo</i> [Sulphuric Acid and Industry]
Plast Rubber..... <i>Plastics and Rubber</i>	Safety Sea Internat..... <i>Safety at Sea International</i>
Plast Technol..... <i>Plastics Technology</i>	S Afr Min Eng J..... <i>South African Mining and Engineering Journal</i>
Polizei Tech Verkehr..... <i>Polizei-Technik-Verkehr</i> [Police and Traffic Safety Engineering Journal]	Sangyo Anzen Kenkyusho Kenkyu Hokoku..... <i>Sangyo Anzen Kenkyusho Kenkyu Hokoku</i> [Research Reports of the Research Institute of Industrial Safety]
Polym Eng Sci..... <i>Polymer Engineering and Science</i>	Sangyo kikai..... <i>Sangyo kikai</i> [Industrial Machinery]
Polytech Tijdschr. Bouwkunde, Wegen en Waterbouw..... <i>Polytechnisch Tijdschrift. Bouwkunde, Wegen en Waterbouw</i> [Polytechnical Journal. Construction, Roads, and Hydraulics]	Sapeur pompier..... <i>Sapeur pompier</i> [Firefighter]
Powder Metall..... <i>Powder Metallurgy</i>	SBB Nachrichtenbl..... <i>Schweizerische Bundesbahn. Nachrichtenblatt</i> [News Bulletin of the Swiss Federal Railway]
Power Eng..... <i>Power Engineering</i>	Sb Nauch Tr Leningr Vyssh Inzh Mor Uchshche..... <i>Sbornik Nauchnykh Trudov, Leningradskoye Vysshee Inzhenernoye Morskoe Uchilishche</i> [Digest of Scientific Papers, Leningrad Advanced Naval Engineering Academy]
Pozhar delo..... <i>Pozharnoye Delo</i> [Firefighting]	Sb Tr VNI protivopozhar oborony..... <i>Sbornik Trudov Vsesoyuznogo Nauchno-Issledovatel'skogo Instituta Protivopozharnoy Oborony</i> [Digest of Papers of the All-Union Fire Protection Research Institute]
Pozhar okhrana..... <i>Pozharnaya okhrana</i> [Fire Protection]	SBZ..... <i>Sanitaer-Technik, Heizungs- und Lueftungsbau</i>
Pr Cent Inst Ochr Pr..... <i>Prace Centralnego Instytutu Ochrony Pracy</i> [Proceedings of the Central Occupational Safety Institute]	
Prakt Anaesth..... <i>Praktische Anaesthesie</i> [Practical Anesthesiology]	
Pribory i sistemy upr..... <i>Pribory i Sistemy Upravleniya</i> [Control Instruments and Systems]	
Proc West Pharmacol Soc..... <i>Proceedings of the Western Pharmacology Society</i>	
Prof Saf..... <i>Professional Safety</i>	
Progr Archit..... <i>Progressive Architecture</i>	
Prom energ..... <i>Promyshlennaya energetika</i> [Industrial Power]	
Prom Stroitel..... <i>Promyshlennoe Stroitel'stvo</i> [Commercial Building Construction]	
Prot Civ Secur Ind..... <i>Protection Civile et Securite</i>	

EXPANSIONS OF JOURNAL ABBREVIATIONS

<i>)Sanitary Engineering] Heating and Ventilation Construction?</i>	Textilia <i>Textilia</i> [Textiles]
Schadenprisma <i>Schadenprisma</i> [Damage Prism – Journal of Damage Prevention and Research]	Text Inst Ind <i>Textile Institute and Industry</i>
Schiff Hafen <i>Schiff und Hafen</i> [Ships and Ports]	Text Prax Int <i>Textil-Praxis International</i> [International Textile Engineering]
Schweiz Feuerwehr Z <i>Schweizerische Feuerwehr Zeitung</i> [Swiss Fire Protection Journal]	Text Res J <i>Textile Research Journal</i>
Science <i>Science</i>	Tijdschr watervoor en afvalwaterbehandel ... <i>Tijdschrift voor watervoorziening en afvalbehandeling</i> [Water Supply and Waste Treatment Journal]
Seewirtschaft <i>Seewirtschaft</i> [Maritime Affairs]	Tokyo daigaku kogakubu kiyo, A <i>Tokyo daigaku kogakubu kiyo, A</i> [Journal of the Faculty of En- gineering, University of Tokyo, Series A]
Seisan kenkyu <i>Seisan kenkyu</i> [Monthly Journal of the Institute of Industrial Science of the Univer- sity of Tokyo]	Torf Prom <i>Torfyanyaya Promyshlennost</i> [Peat Industry]
Seisan to denki <i>Seisan to denki</i> [Production and Electricity]	Toshiba Rebyu <i>Toshiba Rebyu</i> [Toshiba Review]
Sharyo kogaku <i>Sharyo kogaku</i> [Railway Car Engineering]	Tr Inzh-ekon Fak Rizh Politekhn In-ta <i>Trudy Inzhenerno-Ekonomicheskogo Fakul'teta Rizhskogo Politekhnicheskogo Instituta</i> [Transactions of the Faculty of Engineering Economics of the Riga Polytechnic Institute]
Sharyo to Denki <i>Sharyo to Denki</i> [Railway Car and Electrical Equipment]	Tr Vost NII po bezop rabot v gorn prom- sti <i>Trudy Vostochnogo Nauchno-Issledovatel'skogo Instituta po bezopasnosti rabot v gornoy promyshlennosti</i> [Transactions of the Eastern Scientific Research In- stitute for Industrial Safety in the Mining Industry]
Ship World Shipbuild <i>Shipping World and Shipbuilding</i>	Trans AIJ <i>Transactions of the AIJ</i>
Sichere Arb <i>Sichere Arbeit</i> [Labor Safety]	Uch Zap Azerb in-ta Nefti i Khimii <i>Uchenye Zapiski Azerbaidzhanskogo Instituta Nefti i Khimii</i> [Scientific Papers of the Azerbaidzhan Institute of Petroleum and Chemistry]
Sicherh Bergbau, Energiewirt, Met <i>Sicherheit Bergbau, Energiewirtschaft, Metallurgie</i> [Safety in Mining, Power Industry and Metallurgy]	Ugol <i>Ugol</i> [Coal]
Sicherheitsing <i>Sicherheitsingenieur</i> [Safety Engineer]	Ugol Ukraina <i>Ugol Ukraina</i> [Ukrainian Coal]
Siemens Rev <i>Siemens Review</i>	Uni-Inf Karlsruhe <i>Universitaets-Information Karlsruhe</i> [Karlsruhe University Bulletin]
Siemens Z <i>Siemens Zeitschrift</i> [Siemens Journal]	Unser Brandschutz <i>Unser Brandschutz</i> [Our Fire Protection]
Sigurnost <i>Sigurnost</i> [Safety]	VDI Z <i>Zeitschrift des Vereins Deutscher Ingenieure</i> [Journal of the German Engineers Society]
Soda to enso <i>Soda to enso</i> [Soda and Chlorine]	Verfahrenstechnik (Mainz) <i>Verfahrenstechnik</i> [Process Engineering]
South Build <i>Southern Building</i>	Versicherungswirtschaft <i>Versicherungswirtschaft</i> [Insurance Industry]
Stahl Eisen <i>Stahl und Eisen</i> [Steel and Iron]	Vet Med Small Anim Clin <i>Veterinary Medicine and Small Animal Clinician</i>
Steir Feuerwehrbl <i>Steirisches Feuerwehrblatt</i> [Styrian Fire Services Journal]	VFDB Z <i>Zeitschrift der Vereinigung zur Foerderung des Deutschen Brandschutzes</i> [Journal of the As- sociation for the Advancement of Fire Protection in Germany]
Str-vo truboprovodov <i>Stroitel'stvo truboprovodov</i> [Pipe Construction]	VGB Kraftwerkstechnik <i>Vereinigung der Grosskraftwerksbetreiber – Kraftwerkstechnik</i> [Association of Major Power-Plant Operators. Power-Plant Engineering]
Sud Med Ekspert <i>Sudebno-Meditsinskaya Ekspertiza</i> [Expertise in Forensic Medicine]	Voен Med Zh <i>Voenno-Meditsinskiy Zhurnal</i> [Military Medical Journal]
Surg Clin North Am <i>Surgical Clinics of North America</i>	Vopr ekon pozhar okhrane <i>Voprosy ekonomiki v pozharной okhrane</i> [Problems of Economics in Fire Protection]
Surg Forum <i>Surgical Forum</i>	Werkfeuerverband eV. Rundschreiben <i>Werkfeuerverband</i>
Tankstelle <i>Tankstelle</i> [Service Station]	
Tech Mitt <i>Technische Mitteilungen</i> [Technical Communications]	
Tech Mod <i>Technique Moderne</i> [Modern Technology]	
Technica (Switz) <i>Technica (Switzerland)</i> [Technology]	
Technocrat (Japan) <i>Technocrat (published in English)</i>	
Tech Ueberwach <i>Technische Ueberwachung</i> [Technical Security Supervision]	
Telecomm J <i>Telecommunication Journal</i>	
Telecomm J Australia <i>Telecommunication Journal of Australia</i>	
Tenside Deterg <i>Tenside Detergents</i>	
Tetsudo Doboku <i>Tetsudo Doboku</i> [Railway Civil Engineering]	
Tetsudo Gijutsu Kenkyu Shiryo <i>Tetsudo Gijutsu Kenkyu Shiryo</i> [Journal of Railway En- gineering Research]	
Text Chem Color <i>Textile Chemist and Colorist</i>	

EXPANSIONS OF JOURNAL ABBREVIATIONS

eVz Rundschreiben)Industrial Fire Brigade Association Incz Circulars?

West J Med	<i>Western Journal of Medicine</i>
Wiad Gorn	<i>Wiadomosci Gornicze</i> [Mining News]
World Oil	<i>World Oil</i>
Yuatsu Gijutsu	<i>Yuatsu Gijutsu</i> [Hydraulics Engineering]
Yuatsuka sekkei	<i>Yuatsuka sekkei</i> [Hydraulics and Pneumatics]
Zem Kalk Gips	<i>Zement-Kalk-Gips</i> [Cement-Lime-Gypsum]
Zentralbl Arbeitsmed Arbeitsschutz	<i>Zentralblatt fuer Arbeitsmedizin und Arbeitsschutz</i> [Journal of Industrial Medicine and Occupational Safety]
Zesz probl gorn	<i>Zeszyty Problemowe Gornictwa</i> [Reports on Mining Research]
Zh Vses Khim O-va	<i>Zhurnal Vsesoyuznogo Khimicheskogo Obshestva imena D I Mendeleeva</i> [Journal of the DI Mendeleev All-Union Chemical Society]
ZS Magazin	<i>Zivilschutz Magazin</i> [Civil Defense Journal]





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